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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

VOLUME XIX.

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ERRATA.

On page 88, last line of second column, for 'Terminal Catappa' read *Terminalia Catappa.*

„ „ 218, paragraph 2 of second column, for 'McCulloch' read *McColloch.*

„ „ 250, paragraph 2 of second column, for 'Crotolaria usamaroeusis' read *Crotalaria usamaroensis.*

„ „ 262, Fig. 11, for 'growing' read *grafting.*

„ „ 266, Fig. 13, for 'quadrimaculatas' read *quadrimaculatus.*

„ „ 292, last line of second column, for 'Melanopsamnnopsis' read *Melanopsammopsis.*

„ „ 341, for 'Kieselghur' read *Kieselguhr.*

„ „ 349, first line of first column, for 'AND read *A.*

„ „ 362, paragraph 3 of first column, for '1920' read *1912.*

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The Value of Continuity in Experimental Agriculture.

THE editorial in the *Experiment Station Record*, June 1919, brings out in a very striking way the necessity as well as the value of accumulated information in the solution of scientific problems, especially those relating to agriculture.

Seeing that science enables the relation between cause and effect to be traced, and seeing that the knowledge it establishes is exact, it may be said broadly that the final function of science is to be able to prophesy with certainty what will take place under given conditions.

Science also supplies a background of accumulated information, and herein lies the value of continuity in regard to such information.

Another reason for the continuous accumulation of information is that science is never complete ; it is in continual process of being added to. It is constantly searching for facts, advancing its boundaries step by step, thus making its prophecies more certain of fulfilment. The function of science is not only to contribute a mass of substantive facts, but also to disclose the real nature of complex problems, thus making their solution more feasible.

In agriculture long years of research have been required to lay bare the real underlying problems, and to suggest how they might best be solved; to show, for example, what factors were actually involved in the growing of crops and the feeding of plants, data had to be accumulated under a variety of circumstances as to the conditions prevailing in successful practice of agriculture, and the results of definite combinations of such conditions recorded. Gradually facts have been accumulated, whereby an insight into the true nature of the problems has been largely obtained, serving as a basis for further investigations.

The ultimate solution of an agricultural question is largely facilitated by understanding

its real nature. For instance, for many years there was great confusion in discovering and developing the laws of heredity, but Mendel taught that success depended in fixing attention, not on the organism as a whole, but upon one after another of its various attributes or characters. Thus the problem of inheritance became simplified and susceptible of solution by ordinary methods of experiment based on continuous accumulated records of observation.

The understanding of what is fundamentally involved in a complex problem of agricultural practice is necessary. It is the function of science in agriculture to find this out, in order that the solution of the problem may be disclosed, and practice rightly guided in the future. The work of agricultural departments has resulted in material progress in this direction, owing very largely to their possessing accumulated and continuous records of facts observed under varying conditions. There does seem, however, to be the danger of viewing subjects rather as a whole than as made up of many complex points. Sometimes investigations seem to be over ambitious in their scope, because of inattention to underlying features which might be more profitably studied in detail before attempting the solution of a general problem. Questions of soil, of the relation of cropping to fertility, for example, are extremely complex as to their real nature, and are impossible of being worked out successfully in their entirety as single investigations.

It must not be forgotten that there is a distinction between what might be desirable to accomplish in the interests of agriculture, both as regards its science and its practice, and what it is possible to attain in the present state of knowledge. Questions frequently present themselves to the attention of both scientific men and practical agriculturists which it is not practicable to solve at present, either because there is not a sufficient background of accumulated and recorded observations to enable the problem to be thoroughly understood, or, on the other hand, because the methods for handling it are not sufficiently developed. Investigation cannot successfully progress much faster than the methods and the means of study available, and not more rapidly than general science clears the field, and enables working hypotheses to be put forward. While the original investigator develops new lines of reasoning or new methods of attacking a problem, he must necessarily rely largely upon the employment of existing knowledge as a means of attaining his end. Hence short cuts to the solution of agricultural problems are rarely successful. In the effort to bridge too wide a gap between what is known and what is unknown, facts and methods are sometimes assumed which have not yet been fully proved, and delay and confusion are thus caused.

There are many subjects, like studies in breeding of plants and animals, the physiology of nutrition, the effects of soil treatment, the working out of intricate questions of disease both in animals and plants, which require long and persistent study, and the ultimate solution of such questions cannot be hurried. There are others which require the systematic accumulation of data under a variety of conditions and over long periods. These data must be looked upon as records of unanalysed evidence, not as established facts or even theories, but fundamental for the establishment of theory.

To take a familiar example, it has long been known that land can be cropped continuously for a long time, often with surprising results, and that fertility may be maintained and even improved by combinations of crops, fertilizers, and soil treatment. Whether this is or is not fundamentally true is no longer a question for lengthy experiment; the general truth is no longer open to question. Some development and local adaptation may be needed in various localities, but the underlying question for research lies beyond this point. Research nowadays concerns the reasons, the changes in conditions which are brought about, the relations of various classes of factors which are in operation, the means of maintaining the proper balance in these factors, and matters of this sort. These are not solved by growing and harvesting crops in rotation through a long period, even if the greatest possible care is observed, or by the chemical analysis of the crops and of the soils at intervals of several years, or even by sampling the plots occasionally for bacteriological examination. It is where such series of experiments are utilized to study certain definite limited questions that they throw new light on the subject. The taking of data and the recording of them are of the greatest profit when regarded in relation to the purpose and use made of them. Correlation studies, for example, through long periods, and resulting in volumes of data, unless they are interpreted in relation to some particular problem, do not directly advance knowledge, but they are indispensable as a foundation for further research.

The importance of preserving the records of experiments carried out, or observations actually made, can hardly be overestimated, as this accumulation of

data often affords valuable information to investigatrors when search is made in it. It frequently happens that one observer has recorded something which, although of no particularly apparent value at the moment, proves illuminating to subsequent observers. Although the first observer may have been unable to make any application of the points or facts recorded by himself, his work bears fruit because the record of it is preserved. The records of experiment stations are of great value in this respect, and often afford a mine of information to subsequent investigators.

AGRICULTURE AND INDUSTRIES IN THE TURKS AND CAICOS ISLANDS.

The report for 1918 of the Commissioner, Mr. G. Whitfield Smith, embodied in Colonial Reports— Annual. No 1009, presents a somewhat gloomy picture of future prospects in agriculture and other industries in the Turks and Caicos Islands.

The contemplated shutting down of the East Caicos Fibre Company's factory appears to render it practically certain that sisal cultivation in the Caicos Islands will be discontinued, at any rate for some years, since no effort is being made to replant or to open up fresh areas It is to be regretted that an industry specially suitable to climatic and soil conditions in the Caicos Islands should cease to exist, particularly as it lately appeared full of promise The abandonment of sisal cultivation will be a severe blow to East Caicos, the inhabitants of which mainly depended on the fibre factory for a livelihood An evidence of the decline of this industry is afforded by the fact that whereas sisal to the value of £5,950 was exported in the year 1917, the value of the export in 1918 had fallen to £942.

As a slight set off to the conditions of the sisal industry, it appears that a small amount of cotton, to the value of £617, is first included among the exports of these dependencies.

The history of the cotton plant in the Caicos Islands is interesting. It would seem that at the time of the settlement of the Caicos Islands, soon after the revolutionary war between the United States and Great Britain, a number of gentlemen formerly residing in American colonies obtained grants of land from the British Government in the Caicos Islands. These white settlers and their white decendants have long passed away, and the decendants of their slaves constitute the bulk of the inhabitants of the Caicos Islands to-day. These settlers brought with them seeds both of the Sea Island and Upland cottons, but for various reasons the cultivation of the plant never attained any large proportions. Cotton plants were however allowed to grow up uncared for in waste places near to the settlements, where amid the cactus scrub they pursued for over a century a struggle for existence, evolving eventually a type of cotton plant that for hardiness, freedom from disease, and heavy cropping qualities, under almost unbelievable conditions of sterility and neglect, cannot, it is believed, be surpassed anywhere.

In the year 1915 the Commissioner's attention was attracted to this unusual type of cotton The report of Messrs. Wolstenholme and Holland of Liverpool on a sample of lint forwarded to them proved so satisfactory, that efforts were made in 1916 to induce peasants to take up cotton cultivation on systematic lines.

This was a hard task at first, on account of the ignorance of the people of even the simplest agricultural methods. Owing, however, to the satisfactory results of the first shipment of 3 bales of cotton in 1916, they have been led to realize that there is a value in land, and have been stimulated to further efforts. Progress, though slow, is being steadily achieved in this direction. It would seem that if carefully fostered and encouraged the cotton industry will before long benefit immensely those islands, since there are thousands of acres of land in them suitable for this cultivation. It is recognised that the cotton cultivation in the Caicos Islands should be on the lines so successfully adopted in the Grenadines by the Government, and that every precaution should be taken to prevent the introduction of cotton seed from outside, with the attendant dangers. The native type, the shipment of which in 1918 sold for 1s. 8d. per pound was reported by the brokers as being of good quality and strength, with the remark there was always a fine market for this quality of cotton. The type, though possibly not the highest grade of Upland cotton, is especially suitable to the habits of a people who would not look at the industry if the plant required any care beyond sowing and reaping. It might be interesting to ascertain what this type of cotton would do under more favourable conditions of growth and treatment

With regard to minor industries it is not pleasant to note that there has been a steady decline in them all as compared with previous years, with the exception of the export of dried conchs, of which over three millions, of an estimated value of £3,371, were exported to the neighbouring Republic of Haiti during the year.

Sponge culture cannot be any longer considered a valuable asset among the minor industries, though there is no doubt that sponge culture might be carried on successfully and largely developed in the shallow water creeks of the islands. The export of sponges for the year 1918 showed a decrease of £369 when compared with that of 1917.

One of the principal industries of Turks Islands is salt; and here again there has been a great decliue in the value of the export. Salt manufactured on such expensive and antiquated lines as obtain in the Turks Islands must always be at a great disadvantage in competition with that produced by more progressive salt exporting countries.

It is pleasant to find, with regard to the work of the Agricultural and Industrial Society of these islands, that the Society, only started in 1915, has now 263 names on its register, and has done much to foster and encourage a taste for agriculture among peasant growers throughout the dependency.

The *Journal of Heredity*, November 1919, draws attention to a remarkable bud sport in a plant of *Pandanus utilis*. This plant, having been grown for some years in a pot, was transplanted into a bed of rich earth. The habit of growth of this species, as is well known, is with its leaves arranged in spirals. Soon after transplanting the plant underwent a mutation in the arrangement of the leaves. After growing for some time, the plant presented the aspect of a great fan, putting one in mind of the habit of growth of the traveller's palm, (*Ravenala madagascariensis*).

REPORT ON THE AGRICULTURAL DEPARTMENT OF THE GOLD COAST, FOR THE YEAR 1918.

In this report, which has just been received, Mr. Tudhope, the Director of Agriculture, devotes, as is natural, much space to cacao, the principal product of the colony.

The actual export figures of this product for the two years 1917-18 show that the production is still on the increase. In spite of the difficulties experienced with regard to shipment, a record was established in 1917 of 90,964 tons. There was a reduced export of 66,343 tons in 1918, which was due to a still more acute shortage of shipping, the greater part of the season's cacao remaining on hand at the end of the year. The average shipment of thes two years even under the adverse conditions, is still in advance of any previous year. Mr. Tudhope estimates that the Gold Coast annual crop of cacao is very nearly half the production of the whole world.

Owing to the difficulties mentioned above, the prices offered for cacao beans were at such a low level that in large tracts of country the crop could not be gathered without loss to the growers. The result has been that cacao farms in the remoter districts have been abandoned to a great extent. This neglect of the plantations, it is feared, will lead to the probable increase of diseases, and will necessitate more energetic and persistent attention than has been employed in the past to keep them in subjection.

The depression in this leading industry has to some extent revived interest in other products, such as oil palm kernels, and kola nuts, the production of these having increased in recent years. The cultivation of foodstuffs has also increased, so that no actual shortage has been apparent; minor industries have also received some attention. The recent depression in the cacao industry may not be an unmixed evil; it may tend towards the permanent good of agriculture in the colony by proving that it is unwise to concentrate attention on one product only, however promising the outlook for the time being.

With reference to the great extent of country now under cultivation in cacao trees, Mr. Tudhope points out that it is impossible for the present small staff of the Agricultural Department to keep an efficient oversight over it, along with other agricultural duties.

The agricultural stations at various parts of the colony perform an important work in experimenting with different crops, and accumulating data of value, not only as regards the yield of different varieties, but also in ascertaining the suitability of plants for the various districts. The accumalation of such data gradually enables the Department to propagate and distribute seeds and plants of known pedigree, and of proved suitability. Mr. Tudhope rightly regards the work in this direction as of great importance. The agricultural stations also serve a very useful purpose as centres for demonstrating proper cultural methods, and the correct preparation of the various products for sale.

Returning to the subject of cacao, Mr. Tudhope thinks that one effect of the depression in the trade has been to arrest further extension of plantations, which may be a blessing, as the tendency in previous years has been to go on extending, in the mistaken belief that the larger the area the bigger the profit, without attention to the care of the trees. In some of the remoter districts plantations are to be seen in a deplorable condition, the trees being attacked by the Loranthus parasite, dead and decayed branches covered with white thread fungus, and occasional dead trees killed by root disease, together with a perfect forest of young cacao seedlings springing up all round, and suckers absolutely untended.

As proving the benefit of proper cultivation, the results of experiments on previously abandoned or neglected native plots on the land of two of the stations are given.

At Assuantsi, two small plots of old and abandoned trees were in such a condition that no cacao was produced. In 1909 they were thinned out and thoroughly overhauled, producing a crop in 1910 of 611 pods. These plots have been properly attended to since, and have naturally responded to the care bestowed on them, the crop in the year 1918 having been 9,845 pods.

At Peki, land planted in the ordinary native fashion produced a total of 7 878 pods in 1913, of which 12·36 per cent. were diseased. The trees were then thinned out, pruned, sprayed, and mulched, and have continued to receive proper treatment. The result has been that in 1918 the yield from a much smaller number of trees was 19,249 pods, with only 3·79 per cent. diseased or useless.

The greater attention which is being paid to the collection of oil palm products is almost entirely due to the depression in the cacao market. But it also may be accounted for, to some extent by the greater demand for vegetable oils in Europe. On account, however, of the abandonment in past years of the care of the oil palms, the yield was not as good as might have been expected. It is doubtful if when the cacao trade revives, the increased production of palm nuts will be maintained, since under local conditions cacao is more easily produced, and has a higher unit value. If appreciable development in these products is to take place, it would seem that the erection of central factories with suitable machinery is essential.

Another crop of minor importance that has also received more attention during the year under report is kola. These nuts are produced on an indigenous tree found chiefly in the evergreen forests. The trees receive no cultivation whatever. Experiments are being undertaken at the different agricultural stations as to their cultivation on plantation lines. The seeds of the white or 'Kirg' kola are worth three or four times that of the ordinary variety.

The cultivation of coco-nuts has extended to a considerable extent in certain districts of the colony. During the past two years about 25,000 nuts have been distributed by the Department. It appears probable that this cultivation will make most progress amongst the fishermen of the coast.

The production of rubber from native trees and vines has greatly diminished, owing to the destruction of a large number of such plants. Para rubber trees are, however, now being planted in increased numbers.

There is only a small export of cotton, but there are indications that it has been receiving more attention during the past two years.

The cultivation of limes, which seem very little affected by insect pests, and which give heavy crops, is receiving the special attention of the Department.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. VINCENT. Work in the Botanic Gardens in November included experiments with the curing of vanilla beans. Plant distribution was as follows: 400 cacao, 109 cocc-nut 114 decorative, and 200 cane plants. A considerable amount of damage, writes Mr. Jackson, was done to the cotton crop by heavy rains experienced during the month. A fair amount of boll-shedding took place, and many bolls were destroyed by fungoid diseases, soft rot, etc. The seeds in bolls which had opened, commenced to germinate before the cotton could be picked. The area in the colony under cotton during the present season—the largest on record—is more than 6,633 acres, which include 1,554 acres of Marie Galante cotton in the Grenadines, and 580 acres in St. Vincent. At the Granary, 37,712 lb. of shelled corn and 36,536 lb. of cob corn were purchased; the quantity of corn kiln-dried amounted to 79,391 lb At the Ginnery 32,196 lb. of seed-cotton were received for ginning Seed cotton purchased amounted to 19,853 lb. Attacks of cotton worms are reported to be decreasing. These were chiefly confined to estates on the windward side of the island. The Government proposes in future to have always on hand a supply of Paris green. The rainfall registered at the Botanic Station during the month was 23·07 inches; at the Experiment Station the record was 21·07.

ST. LUCIA. Plant distribution during the month of November included: limes, 300; grafted mangoes, 8; cacao, 48; nutmegs, 40; sugar cane cuttings, 26; economic, 4; ornamental cuttings, 250; vegetable seeds, 8 packets; lime seeds, 1 box. Regarding staple crops, Mr Brooks, the Agricultural Superintendent, states that small pickings of cacao are still being made; the lime crop is slackening, while reaping operations have commenced in connexion with the sugar crop. Lectures on agriculture were delivered by Mr. Niles in the country schools. The rainfall recorded at the Botanic Gardens, Castries, during the month was 14·78 inches; at the Agricultural and Botanic Station, Choiseul, 15·41 inches.

NEVIS. Mr. W. I. Howell Agricultural Instructor, writes to say in reference to the Experiment Station, that the crops have made rapid progress during the month of November, and the condition of the Station is more satisfactory. Plant distribution for the month included 16,600 sweet potato cuttings and ½lb. of Para peas. The cane crop throughout the island, Mr. Howell states, has made very rapid progress during the month, and the returns will be very much better than was anticipated. The preparation and planting of next crop are in progress, and the acreage will be considerably increased. Reaping has begun on two estates, where sugar and syrup for local consumption are being made. Practically the whole of the peasants' cotton crop in the island has been destroyed by the cotton worm; a considerable proportion of the larger growers' crops has also been destroyed; in very few cases have the crops escaped damage. This destruction was largely due to the planters not having on hand a sufficient supply of insecticides. Cotton stainers are not as prevalent as in the past, but boll dropping is occurring throughout the island. A large area was planted in provision crops during the month. The rainfall totalled 7·22 inches.

VIRGIN ISLANDS. Usual routine work is reported in the Experiment Station, Tortola, during November. Eleven ornamental plants and 1,250 onion seedlings represented the plant distribution. Copious showers towards the end of the month improved the general aspect of the different crops. The cotton factory was reopened on October 17. The tota rainfall amounted to 6·72 inches.

AGRICULTURE IN BARBADOS.

The year 1919 will long be remembered in Barbados for the severe drought which extended over the first six months of it. It will also be remembered for the erratic and, in some respects, partial rainfall which marked the last six months of the year. Up to the end of June the total rainfall over a large area of the island was under 9 inches, and the year will close with a total of about 16 inches in the red soil, and 19 inches in the black soil less than the total reached during 1918. Only in the month of August was there really wet weather, and on the 25th day of that month there was a rainstorm of great violence over the western and south-western portions of the island.

On the whole, December has been favourable, although a heavier rainfall—St. Lucy excepted—would have forced on the crops more. With such a rainfall as that recorded for 1919 the wonder is that the crops have stood their ground so well. Planters may be very grateful that August was such a favourable month. It was this month which revived hope and resuscitated the crops. At the present time it appears that next year's crop will not be more than 30 per cent. under the output of this year; but, of course, reaping operations will be started much later. The manuring of the fields for the young crop still proceeds apace. In many districts there is no hope of completing this work for at least two months to come, and this after a considerable acreage has been fertilized with sheep manure.

The spring of the young crop promises to be excellent. The regularity of the spring of the B.H.10 (12) is marked. In some fields planted in this seedling every hole seems to have germinated healthily. Supplying is now in full swing everywhere.

At the Industrial Exhibition held at Queen's Park on December 17, three of the six prizes given for plant and ratoon canes were awarded for clumps of the seedling B.H. 10(12), two for clumps of the Ba.6032, while only one prize was gained by the B.6450. We should have liked to have seen a larger number of exhibits of our staple product. It is doubtless troublesome to dig up and remove from a field a fine clump of canes, but our agriculturists, to use a sporting term, should endeavour to 'play the game.'

Considering the weather which has prevailed this year, the show of vegetables and rind fruit at the exhibition was a very fair one.

There are now twenty-two factories making crystals, and eight manufacturing muscovado. The total output of sugar of these factories for the last two years was: in 1918—crystals, 30,904 tons, muscovado, 5,363 tons; in 1919—crystals, 42,535 tons, muscovado, 7,176 tons. We would observe that co-operation has caused the greatly increased tonnage of crystals for 1919.

Yams, rind fruit, and cereals are very scarce, and potatoes are gradually rising in price. Practically the whole of the Lisbon yam crop is still to be reaped, but the return is likely to be far below last year's (The Barbados *Agricultural Reporter*, December 24, 1919.)

COTTON.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co. on Sea Island cotton in the Southern States, for the week ended December 13, 1919, is as follows :—

ISLANDS. The demand has continued for the small offerings of Fine to Fully Fine at 82c. the buying being on account of the Northern Mills. As the crop is a small one the supply of this quality may be largely sold before the holidays.

The planter's crop lots of the Extra Fine are firmly held at prices ranging from $1·00 to $1·50. There is apparently no demand at present for them, and it is probable that with orders in hand enabling one to make a positive bid, holders may make concessions to sell.

We quote, viz :—

Fine to Fully Fine @ 85c., f.o.b. and freight.
Fine to Fully Fine, off in preparation, 83c. f.o.b. and freight.

GEORGIAS AND FLORIDAS. The market is very firm with good demand on a basis of quotations, the buying being on account of the Northern Mills, and the unsold stock is fast disappearing.

You will see from the Ginners' Report that the crop will be even smaller than the Government's estimate at the early part of the season. Very little new cotton has been put on the market, there having been ginned this year only 3,217 bales against 22,207 bales last year. The business consequently has been done principally in cotton brought over from the crops of 1917-1918 and 1918-1919.

We quote, viz:—

Average Extra Choice, @ 83c. to 84½c. f.o.b. and freight.

The exports from Savannah for the week have been 379 bales to Northern Mills, and from Jacksonville 266 bales, to Northern Mills.

The U.S. Census Bureau reports the amount of Sea Island cotton ginned to December 1, as follows :—

South Carolina	1,482 bales	making a total of 5,589 bales			
Georgia	564 bales				
Florida	2,180 bales				
against last year,	25,741	bales.	Total crop		44,380 bales.
,, 1917	77,638	bales.	,,	,,	88,174 bales.
,, 1916	101,620	bales.	,,	,,	113,109 bales.
,, 1915	77,161	bales.	,,	,,	85,278 bales.

CANE-SUGAR PRODUCTION IN INDIA.

It is estimated that British India produces about 2,250,000 tons of cane sugar—it is true of a very low grade—and in addition to this, imports about 800 000 tons more. It used to be the largest sugar producer in the world, until surpassed by Java, and in recent y ars by Cuba.

The sugar produced in India is chiefly in the shape of 'gur,' which is a massecuite from which the molasses has not been drained, but yet the whole mass is comparatively well crystallized. Some of it is also made into what is called 'raab,' which is in fact a variety of muscovado.

Doubts have been expressed in several quarters as to the possibility of developing the cane-sugar industry in India to any considerable extent, and that for two reasons. In the first place it is held that the climate of most of the sugar-cane districts is not suited to the cultivation of any other varieties than the small hardy canes at present grown, which would not justify large outlay for improved machinery. In the second place it is stated that the lands under sugar-cane are generally small areas owned by peasantry, which have remained in the same families for hundreds of years, who have become so conservative that it would be practically impossible to get them to join in furnishing sugar-cane to a central factory.

The *Louisiana Planter*, November 15, 1919, in an article from which the above is largely drawn, goes on to point out that these objections can probably be overcome. In regard to the climate and varieties of cane possible to be grown, the Government of India has now various agricultural experiment stations for the purpose of investigating local possibilities with improved varieties. Dr. C. A. Barber's work in this connexion for many years in India has been frequently referred to in the *Agricultural News*, and there seems little doubt but that this work will prove largely successful.

Sugar-cane is probably indigenous to India, at any rate it has been cultivated there for thousands of years. It is pointed out that the same degrees of latitude, within which the sugar-cane crop of Louisiana is produced, would correspond to those within which most of the area under sugar-cane lies in British India; and we know that Louisiana produces sugar to a large quantity from superior types of cane, at a profit, even with the high-priced American labour. This is of course due to proper methods of cultivation, and the employment of central factories with the most up-to-date machinery.

It would seem that the peasants of India would see that it was to their advantage, if the matter was brought fairly before them, to sell their canes to a central factory at the rate of so much sugar of hard grain and better quality as that which they now secure of their low grade sugars. Although the Hindu is very conservative, there is a certain selfishness in all mankind, so that the Hindu peasant's conservation would probably give way, if he is convinced that it is to his advantage. The central factory system was introduced into the French West Indies in this way, the peasants being paid in sugar or its money value to the same amount as they had got from their individual crops previously, saving all the cost of the process of manufacture, which fell upon the central factory. The Hawaiian sugar manufacturers are now carrying out this plan successfully in dealing with the same kind of peasantry in the Philippines. The Hindu peasant is surely clever enough to realize such advantages, if it is pointed out to him that they are sure to be realized under British Government control. The great advantage that India possesses is that the natives are already familiar to a great extent with the sugar industry, and therefore can more readily understand the situation.

To produce sugar profitably on commercial lines, central factories are nowadays essential, as has been proved in late years in the smaller British West Indies, and as is now understood in Jamaica.

The possibilities of development appear to be immense. There is a population in British India of some 360,000,000 of people; a present production of from 2,250,000 to 3,000,000 tons of low grade cane sugar by the peasants of India; there are also other portions of India where the cultivation of sugar-cane may be undertaken; a country in which the people are of exceptional intelligence, with a civilization which reaches back for thousands of years. Comparing these possibilities of sugar production in India with the results obtained in Louisiana, the writer of the article referred to considers that all difficulties may easily be overcome, and that there is every reason to expect that British India in the future may produce far more sugar

than is produced in the whole of the West Indies, even including Cuba.

Considering that the estimated area under sugar cane in British India is placed in 1918-19 at 2,820,000 acres, it is evident that the sugar industry is of enormous importance to that country, and there does not seem any reason to doubt that very great improvements in the manufacture of sugar in India will not be very far distant in the future.

SEEDLING CANES EXPERIMENTED WITH IN ANTIGUA IN 1919.

At a meeting of the Antigua Agricultural and Commercial Society, December 5, 1919, Mr. A. E Collens, Superintendent of Agriculture, Leeward Islands, presented his report on the results obtained in the varietal cane experiments of the last crop. This report was published in the Antigua *Sun*, December 13, 1919. These experiments, Mr. Collens stated, had been conducted without a break since 1899. He submitted a diagram showing the reported acreage under each variety of cane for the crop, together with calculated yield per acre of cane, and pounds sucrose per gallon in juice of both plants and ratoons.

White Transparent takes the first place with regard to extent of cultivation, 2,101 acres being reported as under this variety, the calculated yield being 15·45 tons of cane as plants and 12·06 tons as ratoons, the calculated sucrose content being 2·11 lb. and 1·99 lb. per gallon in juice, respectively. The second place was held by B.147 with 1,668 acres, giving an average of 17·0 and 9·88 tons of cane per acre, and 1·93 lb and 1·91 lb. sucrose per gallon of juice, respectively. This cane, however, has the reputation of taking long to ripen.

Mr. Collens was glad to see that some of the new varieties which had given good results were coming more into favour. He mentioned especially B.6308, under which 223 acres were reported as planted in 1919. This cane has given an average yield of 23·4 tons as plants, and 15·9 tons as ratoons, with a sucrose content of 2·08 and 2·07, respectively. He also drew attention to B.H.10(12), introduced within the last two years into Antigua. Only a few acres are at present under cultivation in this cane in Antigua, but it appeared to be of great promise, having yielded experimentally 23 tons per acre of cane, with 2·43 lb. sucrose per gallon.

Mr. Collens also exhibited a diagram as regards the results on experiment plots of the best ten varieties of both plant canes and ratoons for the year 1919, and also a table of their previous yields from 1912 onwards.

The first place as a plant cane was held by B.6308, with an average of 23·4 tons of cane per acre, and 2·08 lb. sucrose per gallon. Its average annual yield from 1913-19 was 24·8 tons per acre, as compared with a corresponding average of 16·1 ton for the standard White Transparent, practically the equivalent of 1 ton of sugar more per acre per annum. At Blubber Valley it had yielded 41·06 tons per acre.

The second cane as a plant was B.3922. This cane was also a good ratooner, occupying the third place as an average of eight years trial. The other eight places on the list were also held as plant canes by Barbados seedlings.

With regard to ratoon canes, B. 10650 came first, with a yield of 14·29 tons per acre, as compared with 12 tons for White Transparent, and with practically the same sucrose content per gallon (1·97). This cane had a good reputation in the dry Popeshead District.

The Antigua seedling, A. 319, was second as a ratoon, with 15·0 tons per acre. The sucrose content of this cane is, however, low compared with B. 10650. The other places on the list of ten ratoons were held by other Barbados seedlings.

It was stated by Mr. Henzell, Manager of the Gunthorpes Factory, in remarks which he made after hearing Mr. Collens's report, that the results of the crop just reaped, gave an average of 13 tons cane per acre for the whole island.

In reply to a question Mr. Collens stated that the experiment plots had received average estate cultivation in 1919, but that no fertilizers had been used, as they had been unobtainable.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets for the month of November :—

Business in the London produce markets has been very slack during the early part of the month of November. Buyers continue to make their purchases, in sufficient quantities only to meet immediate demands. Towards the end of the month, however, a slight improvement was apparent in the demand for some drugs and chemicals, but all with an upward tendency in prices. In the middle of the month it was stated that a large amount of business was being transacted again with the Continent through Hamburg.

The following are some of the chief items of interest :—

GINGER, PIMENTO, AND SARSAPARILLA.

At auction on the 13th of the month ginger was in fair supply, good Jamaica fetching from 96*s.* to 105*s.* per cwt., and common to fair 82*s.* 6*d.* to 90*s.* Some wormy brown Calicut was disposed of at 60*s.* Pimento has been in quiet demand throughout the month at 5¾*d.* per lb. At auction on the 20th of the month sarsaparilla was in good supply, being represented by 36 packages of grey Jamaica, 80 of native Jamaica, and 69 of Lima. Of the first named only 18 were disposed of at from 2*s.* 9*d.* to 2*s.* 10*d.* per lb. Of the native Jamaica 68 bales were sold, ordinary to fair red fetching 1*s.* 6*d.* to 1*s.* 7*d.*, and water damaged, 1*s.* 3*d.*

CASSIA FISTULA, LIME JUICE, LIME OIL, ANNATTO SEEDS, ARROWROOT, CASHEW NUTS, KOLA, NUTMEGS, CITRIC ACID.

It was reported at the end of the month that there was a scarcity of good sound Cassia Fistula pods, and that wormy pods were fetching 180*s.* At auction on the 20th of the month 13 puncheons of lime juice were offered but no sales were effected. On the 13th of the month West Indian distilled oil of lime was offered at 2*s.* 9*d.* Annatto seeds were in abundant supply on the 20th of the month, when 273 packages were offered, but no sales were effected. St. Vincent arrowroot was in good supply at auction on the 20th of the month, fair manufacturing being offered at 6*d.* per lb., but no sales were made. Cashew nuts were also abundant at the same auction, but found no purchasers. At the same auction 274 packages of kola were brought forward, but only 38 were sold ; 7*d.* per lb. was paid for fair bright Jamaica halves, while a single bag, designated as 'fair bright West Indian halves,' was sold at 6¾*d.* West Indian nutmegs are scarce in the markets, and there is but little or no difference in the price of the different sizes. Citric acid remains in steady demand at 4*s.* 2*d.* per lb.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

Imperial Commissioner of Agriculture for the West Indies — Sir Francis Watts, K.C.M.G., D.Sc., F.I.C., F.C.S.

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†*Provided by the Imperial Department of Scientific and Industrial Research.*

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial in this number draws attention to the value of continuity in experimental agriculture.

Under Insect Notes, on page 10, will be found an article on a weevil attacking Agave, and also interesting observations on some habits of ants.

The mosaic disease of sugar-cane is the subject of an article under the heading, Plant Diseases, on page 14.

On page 13 will be found an article on recent experiments with regard to the effect of the condition of seeds upon the subsequent growth of plants.

To Prevent Cross-Fertilization of Maize.

Growers of maize are often desirous of keeping good strains pure. H. Wenholz, Inspector of Agriculture, states in the *Agricultural Gazette* of New South Wales, September 1919, that observations have shown that cross-fertilization of maize depends more upon the direction and force of the wind during the tasselling period than upon any other factor. At least a quarter of a mile should separate two varieties sown about the same time, if they are to be kept pure. Should this be impossible, half the distance may suffice, if a tall crop, such as sorghum, lies between. Where the conditions allow of a long planting season, two varieties may be kept pure by allowing at least three or four weeks between the dates of planting. In this case the plots can be adjacent.

An Antidote for Arsenical Poisoning.

Not long ago an instance of arsenical poisoning from the careless use of cattle-tick dip was reported in the Barbados newspapers. With reference to this subject, the *Rhodesia Agricultural Journal*, October 1919, states that because cases of arsenical poisoning sometimes occur as the result of dipping, or of cattle having access to arsenical solution at the dipping tanks, stock owners are advised to keep a few doses on hand, of the following antidote :—

No. 1 Solution—

Official solution perchloride of iron, 3 oz.

No. 2 Solution—

1 oz. of carbonate of soda in 12 oz. of water.

Mix the two solutions, shake well, and administer immediately. A good dose of Epsom salts should be given two or three hours afterwards.

The above solutions may be obtained, prepared ready for use, probably from any chemist.

Observation of Growing Seeds.

In all nature study the observation of the development of the young plant from the seed is always emphasized. It is however rather a difficult matter to watch this development in a normal manner. To take up the little plant at intervals to see how it is getting on, causes an unnatural growth. The *Scientific American*, in a recent number suggests the following simple plan. An ordinary glass jar is lined with thick paper of a somewhat light colour, the interior of the jar is then filled with damp sand or sawdust, which must be kept in a moist state The seeds to be observed are then pushed down in between the paper and the jars. A brown-paper bag or other covering of dark material is employed to keep away the light from the outside of the jar. The moisture from the sawdust or the sand soaks freely through the paper in the jar, and the seeds thus secure all the water needful for their development. At all stages they can be freely examined through the glass without disturbing them in any way, and thus an excellent idea of the manner of growth under fairly normal conditions is obtained.

The Musk Okro.

The above name is given in the West Indies to *Abelmoschus moschatus*, a species of the same genus as the edible okro, which is a native of tropical India, but has been introduced into most other tropical countries. The name given to it is on account of the musk-like odour of the seeds, which arises from an odorous principle contained in them. In fact, the botanic generic name is derived from the Arabic word which means musk. Owing to their possessing this principle, the musk okro seeds are used to a slight extent in perfumery, and are known to the trade in Europe as 'grains d'ambrette'. According to Gildemeister and Hoffmann in their book 'The Volatile Oils,' edition of 1900, the seeds yield on distillation ·02 per cent. of oil. Musk seed when ground resembles in scent the odour of real musk, but it is far less powerful. It is stated that the best seeds for perfumery purposes are exported from Martinique, and according to Père Duss, the plant is cultivated to some extent in that island for the purpose above mentioned.

In Watt's 'Dictionary of the Economic Products of India,' the plant is referred to as the 'musk mallow,' and it is stated that it yields a good fibre, although its cultivation does not possess any advantage over that of jute. He also mentions that the seeds when ground are said to be mixed with coffee in Arabia, probably to impart their odour to the beverage.

There is but small demand for this seed at a moderate price. Should, however, any substantial demand arise, the plant might readily be cultivated in these islands, where specimens are already found growing in gardens.

Plant Quarantine.

The *Monthly Bulletin* of the Department of Agriculture, California, September 1919, contains a short article which brings into prominence the importance of vigilance in small things as to inspection of plants arriving from foreign countries. To the ordinary person one plant, one fruit, or a few seeds bear no significance when compared with large commercial shipments of many cases of plants or packages of fruit; and the zeal with which an inspector attached to the horticultural quarantine department will dissect perhaps one little orange, often brings smiles on the face of its possessor, and an inquiry as to what harm can come from a single fruit. People do not realize that as much harm may come from one orange as from one thousand oranges. Experience has shown that it is often in small things that many new and dangerous pests may be introduced.

Every one seems to have the desire for cultivating a little garden or growing a few trees; and it is this desire that leads many returning travellers from foreign countries to bring back a few seeds of fruit, or plants which are beautiful in the country from which they are returning, and which they hope to grow successfully in their own land. Often too, people bring odd tropical fruits or seeds, merely as curiosities to show their friends. These people do not understand that there may be great danger to the agriculture of their own country in such casual introduction. An instance is given in the discovery of several small branches of a coffee plant in the cabin of a vessel from Honolulu entering a Californian seaport. A traveller had brought these branches, admiring the beauty of the berries, to show his wife what coffee was like on the plant. Examination of the coffee berries showed that practically every one was infested with larvae of the Mediterranean fruit fly (*Ceratitis capitata*), one of the worst insect pests of fruit known.

It should be realized by all travellers that it is not only through large importations that the danger of introducing new pests arises, but that damage of a serious nature may result from one plant, one fruit, even one little seed.

Polyembryony in Plants.

It is well known to botanists and horticulturists that the seeds of certain plants usually contain several embryos. The mango, the rose apple, and the citrus fruits in general, among tropical fruits, are all known to possess this characteristic. In the *Journal* of *Heredity*, November 1919, there is an excellent reproduction of a photograph of a single mango seed from which no less than seven plants are springing. It is presumed in such cases that one of the embryos develops from the fertilized egg cell; the remainder are derived from adventitious buds in the tissue of the nucellus. While the plant arising from the fertilized egg cell may very probably show great variation from its parent, owing probably to cross-fertilization by pollen from a differing individual, the adventitious embryos produce plants whose fruit, it is stated, will resemble that of the parent tree as closely as that of a grafted individual. Owing to this fact many races of mangess aud citrus fruits have been propagated, preserving their original characteristics.

Uses of Castor Oil.

An article in the *Wealth of India*, August 19, 1919, draws attention to various purposes for which castor oil is employed in modern industries. Castor oil, it states, figures to a large extent in the manufacture of the artificial leather which takes the place of natural leather in upholstery. Castor oil is also an essential component in some artificial rubbers and various kinds of celluloid. Castor oil furnishes a colouring for butter; and from castor oil is produced the so-called 'Turkey red oil' which is an important factor in the dyeing of cotton textiles. One of the largest uses of castor oil is in the making of transparent soaps. Castor oil also yields sebacic acid which is employed in the manufacture of candles, and from it is also obtained caprylic acid, which enters into the composition of varnishes peculiarly suitable to the polishing of all kinds of high class furniture and of carriage bodies. Castor oil is also used in the making of certain waterproof preparations. Most fly papers also owe a large part of their effectiveness to the fact that the preparation smeared on them largely consists of castor oil.

INSECT NOTES.

A Weevil Attacking Agave.

A correspondent has recently forwarded to the Imperial Department of Agriculture, for identification, specimens of a weevil attacking Agave in Curaçao.

This insect was not represented in the Department's collection, and it was submitted to the Imperial Bureau of Entomology, where it was identified as *Scyphophorus acupunctatus*, Gyl., an insect which appears to be a native of Mexico where it is very abundant. The Director of the Imperial Bureau of Entomology also states that this insect has been received from two different correspondents in Java, and from one in East Africa, within the past six months, it having evidently been imported with the Agave plants.

In their catalogue of the Coleoptera of the West Indies, Messrs. Leng and Mutchler record the occurrence of the species in Haiti and Cuba. This species is also said to occur in Yucatan.

It would appear from this, that this insect originating in Mexico and Central America, now occurs in Curaçao, Haiti, and Cuba in the Western Tropics, and in East Africa and Java in the East.

Dr. van Breemen, Agricultural Superintendent, Curaçao, who forwarded the specimens, states that the insect attacks *Agave Frankeera*, Trelease. The grubs and weevils occur in great numbers in the stem and leaf-bases of plants that have not yet formed a pole. Dr. van Breemen states that he has also found this insect in *Agave vivipara*, L., where up to the present time it occurs only in the 'bull-end' of the flower pole. It does not appear to attack *Agave sisalana*.

The adult insect or weevil is about 14mm. in length by about 5mm. in width. The colour is a uniform black. The surface of the head and prothorax is smooth, sparsely and finely punctured. The elytra do not reach to the tip of the abdomen. They are coarsely punctured in longitudinal rows. The under surface of the body is sparsely punctured.

The grubs received from Curaçao, in spirit, are about 15mm. in length by 7·5mm. in width. They lack the characteristic abdominal hump of the grubs of the sugar-cane weevil borer of the West Indies, and they are further to be distinguished by the presence of two prominent processes at the anal extremity of the body.

This would appear to be an insect possessing considerable possibilities for harm in localities where henequen cultivation is being started, and if, as is surmised, the insect is introduced with material for planting, the only safe course to pursue would be to import such material only from localities in which careful search indicated that this species does not occur. Once introduced, an insect possessing the habits of this one would be extremely difficult to control, and practically impossible to exterminate, except by eliminating its food-plants.

It is probable that there may occur in its native home in Mexico or Central America some parasite or parasites which exercise a check on the abundance of the weevil, and investigations of the conditions existing in those countries may disclose a parasite which could be profitably transported to those new localities into which the henequen weevil has been introduced.

H. A. B.

AN OBSERVATION ON ANTS.

The following account of what seems to be a well organized effort on the part of an ant community is given here as likely to be of interest to readers of the *Agricultural News*. The observations were made in Barbados, the cockroach mentioned below being the common house cockroach (*Periplaneta australasiae*), and the ant mentioned is the common mad or crazy ant (*Prenolepis longicornis*):—

One morning recently I observed a dead cockroach on the floor in my study, and about an hour after noticed that the ants had found it and were beginning to carry it off. I was struck with two features which seemed unusual, one of which was that the ants were working in a very narrow, direct trail from the door of the room to the cockroach; this trail was almost in a straight line, and was characterized by the lack of stragglers at the sides, which is so common a feature with these ants when they are numerous and busy on a foraging expedition. Another striking feature was the speed at which the cockroach was being moved.

In order to measure the rate of movement I laid an ordinary ruler on the floor at the side of the trail of ants. This seemed to disconcert a large number of the ants, and instead of attending directly to the business in hand, they swarmed over the ruler as if to investigate it and try to find out what it was. This may have somewhat interfered with the pace at which the cockroach was being moved. The observations on this point are as follows: In one minute the cockroach was moved 9 inches, and in eighty seconds it was moved 12 inches along the floor. The ruler was then moved forward along the trail and the same observations taken again. In one minute the cockroach was dragged just short of 9 inches, and the distance of 12 inches was covered in eighty-seconds. It is likely that the slight difference in speed thus shown is due to the fact that more ants were diverted from their work when the ruler was put down the second time, and if the difference shown between these two observations is the same as the difference which occurred between the time the ruler was first put down and the first observation, it would indicate that the cockroach was being dragged at a probably faster rate before the observations began than afterwards.

The cockroach was being dragged on his back; the ants had taken hold on one antenna and one leg, and the body was being hauled consequently nearly broadside on. The surface on which the load was being moved was an ordinary ingrain carpet. The ants on the antenna were ranged for their work as men in a tug of war, and there was less of the indiscriminate hauling in all directions than is often seen at such times.

The crazy ant is an active forager, and often a nuisance from the way which it invades the larders and other stores of food. It does not sting, and is consequently much less undesirable than some other ants.

The room in which these observations were made, and adjoining rooms on the same floor, were a few years ago seriously infested with the small red ant which is capable of inflicting a very painful sting, and which sometimes occurs in enormous numbers. Continual efforts over several months to eradicate this stinging ant only resulted in reducing its numbers, but nothing approaching eradication seemed possible. A small colony of the crazy ant was established on the gallery of the floor below about four years ago. At the present time the crazy ant is found all over the house, and the red ant has entirely disappeared. There is a popular belief in Barbados that the crazy ant drives out or destroys the red ant.

Whether this is true or not, the fact remains that for about four years no attempts have been made to poison or otherwise kill off ants in the house, the red ant has gone, and the crazy ant appears in its place. The red ant was a most decided nuisance; it was very active in search of all sorts of foods, seeming to show a preference for starchy or farinaceous foods; but, its worst feature was its propensity for getting into ones clothes and into beds, and causing great inconvenience by its painful stings

H. A .B.

ENTOMOLOGISTS' VISIT TO THE WEST INDIES.

In the *Agricultural News*. June 29, 1918, there was a reference made to a visit of American zoologists, sent out from the University of Iowa to Barbados and Antigua. The members of the expedition spent the time from May 9 and June 17 in Barbados, and from June 19 to July 19 the month was spent in Antigua.

Mr. Dayton Stoner has contributed some notes on the entomological results of this expedition to the *Canadian Entomologist* for September and October 1919. The writer and his wife, Mrs. Stoner, were attached to the expedition as entomologists, and his notes are of considerable interest

With regard to his observations on Barbados, he finds that in general the affinities of the insect fauna are with those of South America, but a number of North American and closely allied forms are to be found. A few indigenous forms also occur.

The Arachnids are extremely well represented in Barbados, and vary in size from spiders of from 4 to 5 inches in diameter, to the minute Tetranychus. The Barbados tarantula, a tailless whip scorpion, is among the most interesting of the group, and is commonly found under the moist bark of decaying trees.

Myriapods are very common. A black Julid, with transverse markings of green, and averaging from 4 to 4½cm. in length is most abundant.

Scolopendrids are abundant under sticks and stones in damp places. These centipedes are known locally as 'forty legs,' and the popular belief is that a bite from one of them will cause fever in the victim.

Of the Hexapoda there does not seem to be a very great number represented. The order Odonata, on account of the scarcity of breeding places, does not afford many varieties, the common pond fly (*Erythodiplax umbrata*) and the red pond fly (*Tramea abdominalis*) are probably the most abundant.

The order Orthoptera is represented by a goodly number of species. Cockroaches are abundant in cane fields and houses; a half dozen species are found on the island. One of the most common and conspicuous representatives of the group is the large yellowish grasshopper (*Schistocerca pallens*), which is found commonly in the sourgrass fields.

The Hemiptera are the best represented in Barbados of any of the orders, both in actual abundance and in number of species. Of the aquatic forms, the 'water strider' (*Gerris marginata*) is very abundant, and is found in all permanent fresh water streams or ponds of any size. The family Pentatomidae is well represented The two most common species are the green bug (*Nezara viridula*), and the brown bug, known locally as the 'pea chink' (*Edessa meditabunda*). The cotton stainers (*Dysdercus* spp.) do not seem to occur in Barbados, although they are present in almost all the other islands of the West Indian group.

Beetles are well represented in Barbados, and some of them are of considerable economic importance. Among these may be mentioned the Scarabeid beetle, locally called the 'brown hardback' (*Phytalus smithi*), the larvae of which cause great damage to the roots of the sugar-cane. Efforts are being made to control the pest by offering a bounty of 2*d.* per 400 for larvae collected. A small wasp (*Tiphia parallela*) is parasitic on these larvae, but the parasite is not sufficiently abundant to control the pest.

Among the Coccinellids, in addition to the common spotted lady-bird (*Megilla maculata*), the red lady-bird (*Coccinella sanguinea*) is also found, and is even more common than the former.

Of the weevils, the grey and black striped Curculionid (*Diaprepes abbreviatus*) is one of the most common, and at the same time most destructive. The larvae of this insect bore into the sugar-canes, and do much damage.

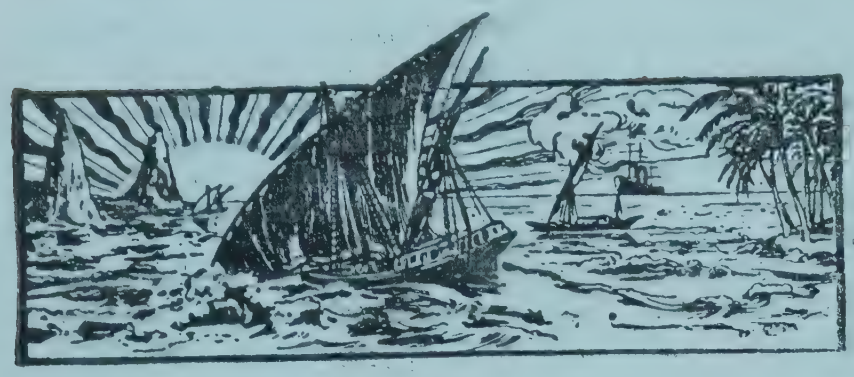
There are not many examples of butterflies on the island, but two of them are well known North American forms, the monarch butterfly (*Anosia plexippus*), and the painted lady (*Vanessa cardui*).

Moths are moderately common, the Sphingids and Noctuids being best represented. Some of these cause considerable damage in the larval stage to crops. Among these are the tobacco worm (*Protoparce cingulata*), the cotton worm (*Alabama argillacea*), the corn ear worm (*Laphygma frugiperda*), and the boll worm (*Heliothis obsoleta*). Perhaps the most common moth of the island is th pretty Arctiid (*Utetheisa ornatrix*), which is particularly abundant on high grassy flats and open spaces.

The Diptera are well represented. Both the filaria mosquito (*Culex fatigans*), and the yellow fever mosquito (*Stegomyia fasciata*) are present, the former being the more abundant.

From the number of brightly coloured flowering trees and plants in Barbados one would naturally expect to find a large and varied hymenopterous fauna. The paucity, however, of the flower-visiting forms is very striking. One of the most conspicuous bees is the large bluish-black carpenter bee (*Xylocopa aeneipennis*) which builds its nest in old posts and decayed branches of trees. The honey bee (*Apis mellifera*) is of course found domesticated as in other countries. Of the wasps, the 'Jack Spaniard' (*Polistes annularis*) is quite common, building its paper nests on the sides of the rocky terraces which are such a marked feature in Barbadian scenery. The family Formicidæ is represented by quite a large number of species.

The Jamaica Banana Trade.—The latest reports received by the Colonial Office as to the extraordinary banana crop of Jamaica show that by the end of the year there will still be left an estimated surplus of 10,000,000 bunches after all shipments now arranged for have been made. In September the price was as low as £7 10*s.* for 100 bunches; now it has risen to £16, and a further rise before long is expected. In one week recently 340,000 bunches were shipped. Among the reasons given for this briskness are a falling-off in the banana supply from Central America, a great demand in America and Europe, and the local contest between the Jamaica Shipping Company, the new concern which introduced the policy of paying the banana growers more than the United Fruit Company and the Atlantic Fruit Company have been paying them. The Pacific Steam Navigation Company, allied with the Royal Steam Packet Company, has arranged to facilitate the shipment of fruit and other produce by linking up Jamaica with New York by a new steamship service between the latter port and Valparaiso, viâ the Panama Canal. (The *Yorkshire Post*, November 25, 1919.)



GLEANINGS.

The California rice-growing industry has in a few years increased from what might be looked upon as merely an experiment stage to a position of equal importance with wheat growing. The value of the industry to the State in 1919 is estimated to be in excess of $15,000,000. (The *California Cultivator*, October 18, 1919.)

A considerable impetus appears to have been given to the maize-growing industry of Rhodesia. Rhodesian maize is rapidly making a name for itself in European markets, and it is significant that South African maize is being quoted there at 5s. per quarter higher than American and Argentine maize. (The *Rhodesia Agricultural Journal*, October 1919.)

The *Agricultural Gazette of Canada*, November 1919, points out that the maple sugar industry in the Province of Quebec has increased threefold during the last three years, owing to the scarcity of beet and cane sugar, and the continual rise in the price of these products. The quantity of maple sugar produced in this Province last year probably amounted to 50,000 000 lb. of the value, at a moderate estimation, of $7,500,000.

The *California Cultivator*, October 25, 1919, states that Orange County in that State has about 5,600 acres in cultivation under various varieties of capsicum. The total output will probably be from 1,800 to 2,000 tons of dried chillies, 500 tons of long red (dry), and 2,500 tons of the latter, used green. It is stated that the monetary returns from the pepper crop will exceed those from oranges, walnuts, beans peaches, apricots, and eggs. The industry is growing by leaps and bounds. Who eats all this hot stuff?

Results of tests on roughages for fattening steers in the Southern States show, taken as a whole, that the Southern farmer can feed steers on cotton-seed meal or cake, and corn or sorghum silage, and produce satisfactory gains at comparatively cheap cost. By this method he not only utilizes his farm-grown crop, but adds to his farm, in the form of manure, the fertilizing elements of the cotton-seed meal fed to his animals. (*Bulletin 762*, United States Department of Agriculture.)

The Board of Trade Journal, November 13, 1919, in reference to the activities of the Advisory Board of Industry and Science of South Africa, draws attention to the development of the cotton-growing industry in the Union. The production in 1910-11 totalled 41,000 lb. of seed-cotton, while that of 1916-17 amounted to 700,000 lb. The desirability of treating the cotton seed on more modern lines is apparent, looking to the large importation of cotton-seed oil into South Africa.

The *Experiment Station Record*, Abstract Number, November 7, 1919, contains a note on extensive tests made by F. C. Bishop and E. W. Laake in 1918, of the dispersion tendency of various species of flies by flight. The experimenters liberated 60,000 marked flies at one point, and 80,000 at another. The greatest distance from the point of liberation at which marked flies were recovered was, for house flies 13 miles, and for screw-worm flies 15 miles.

In the area devoted to tea growing in Ceylon, the cultivation of the castor oil plant is impossible, owing to the plant being the host of the shot-hole borer of tea. Because of the limits placed by the Government of India on the export of castor oil, it was decided to ascertain whether this valuable oil could not be produced in Ceylon outside the tea area. Definite results have not yet been obtained, but the experiments have been interesting and useful. (*Colonial Reports*—Annual, No. 1007.)

It is stated in No. 8, *Agricultural Extension Notes*, issued by the Porto Rico Agricultural Experiment Station, that of twenty-one species of Eucalyptus which have been tested at that station some have shown themselves entirely unsuited to local conditions, while others have grown well. The four most promising are *Eucalyptus citriodora*, *E. robusta*, *E. paniculata*, and *E. corymbosa*. *E. resinifera* and *E. terreticornis* are also promising. The wood of these species lasts well underground. The wood of *E. paniculata* is said to cut almost like horn.

The *Experiment Station Record*, July 1919, quotes from an article on whale meat as food that it is calculated that, after the removal of bone and blubber from whales averaging 50 tons in weight, 5 and 6 tons of flesh available for human food remain. This flesh is said to be very tender, agreeable in taste, and richer than beef in protein by 2 per cent. Some data on shipping whale meat as food from the Canadian Pacific Coast show that, though sales of whale meat are not yet large in Canada or the United States, a good deal, canned or frozen, has been shipped to Samoa and Fiji.

The manufacture of paper pulp in Australia from a native grass known as 'Blady' (*Imperata arundinacea*) promises to be successful. The grass grows in abundance in Northern Queensland, and is found to be very suitable for the manufacture of brown paper and card-board. A factory has been established in the Cairns district in Queensland, and at present it is turning out about 10 tons of pulp weekly, the whole of which is readily absorbed by one mill engaged in making coarse paper. (*Weekly Bulletin*, Department of Trade and Commerce, Canada, November 17, 1919.)

Prof. J. C. McClellan, of the University of Toronto, is reported in *The Times* Trade Supplement, October 4, 1919, to have stated that during the search for helium it was found that practically all the natural gases issuing from wells situated in the Fraser Valley, British Columbia, or from those in the islands of the Gulf of Georgia, consisted of pure nitrogen. These gases, being non inflammable, had been considered of no particular value. If it should turn out, however, that the supply of nitrogen which can be drawn from these wells is considerable and permanent, there is in this resource a basis for the production of cyanide and fertilizers on the Pacific Coast. In this direction there are wealth-producing industries that can possibly be developed with great profit to the Dominion.

THE INFLUENCE OF THE PHYSIOLOGICAL CONDITION OF THE SEED UPON THE SUBSEQUENT PLANT GROWTH.

Recent issues of the *Annals of Applied Biology* contained a series of papers contributed by Messrs. Kidd & West, giving an account of their investigations on the influence of the physiological conditions of seeds upon the course of the subsequent growth and yield of plants. The evidence put forward, regarding the effect of physical and chemical treatments of seeds, may, says the *India Rubber Journal*, November 15, be of considerable interest to rubber planters, when plant breeding operations on rubber plantations are more advanced. According to the authors, the causes which lead to final effects upon yield, which are of considerable magnitude, operate for a short period during the early stages of development, and initiate what they term physiological predetermination. The following is a résumé of the authors' experiments, taken from the *India Rubber Journal*, which seems to be of considerable interest, not only to rubber planters, but to agriculturists in general whose crops are raised from seed.

Among the interesting results obtained, we learn that a brief exposure of air-dried flax seeds to temperatures ranging from 30 to 50 degrees Centigrade, increases the quality and yield of the fibre considerably. With certain cereals it was found that seeds after dry-heating were unusually senitive to climatic and soil conditions during germination. Even X-rays were employed in some experiments, it being found that increased vigour of germination and increased growth of certain plants followed a brief treatment of the seeds to X-rays. In the course of certain chemical treatment some investigators proved that a brief treatment during the initial stage of germination produces a beneficial effect on the whole course of subsequent development of the plants, and also upon their final yields. When experimenting with hydrocyanic acid gas it was found that the dried seeds of corn, wheat, beans, and clover remained without injury to their germinating power for several weeks in an atmosphere containing a quantity of hydrocyanic acid gas, which would normally kill very quickly all insect life. In some particular cases it was even found that if the dried seed was treated with a 1-per cent. solution of boric acid for half an hour only, there was a physical effect upon the resulting plant growth during its whole course. It is pointed out that injury to the young plant may result when the chemicals are applied to the soil, although no injurious effect is obvious when the seeds are treated prior to germination with the same chemicals. Copper treatment of the seeds is fully dealt with, and it is shown that the results are distinctly unsatisfactory, though the effect of copper treatment on the seed is most persistent.

As to the influence of the degree of maturity of the seed at the time of harvesting upon its 'potentiality', all comparisons made between mature and immature seeds were found to be vitiated by the fact that immature seeds deteriorate more rapidly under storage conditions than mature seeds. In many cases it was found that the yield per plant from immature seed was at least equal to that from mature seed.

The most interesting group of facts which have come under review appear to be those brought out by the work of Gassner and others on the effect of low temperatures in predetermining the time of flowering of spring-sown winter cereals. This effect of exposure to low temperatures is a very clear and distinct phenomenon. While it still remains unexplained, the authors claim that it nevertheless bears out the general thesis based on the evidence which they have collected from various sources, namely, that the external conditions which obtain during the early stages of the development of the plant have a very pronounced effect upon its subsequent development. The results of Gassner's investigations show clearly that it is during the first few hours of germination that the 'predetermination phenomenon' can be most easily and quickly brought about by exposure to cold. As the seedling develops, the duration of the exposure to cold and the degree of cold necessary to ensure flowering in the same year rapidly increase.

While much is known with regard to the effect upon germination of various chemical treatments of seeds, very little experimental work is on record with regard to the subsequent growth and yield of the plants produced from the treated seeds. All the available evidence, however, supports the conclusion that where germination and early seedling growth are stimulated by chemical treatment of the seed, the subsequent growth and final yield are favourably influenced in proportion.

One of the most interesting outcomes has been to emphasize the fact that normal plant-growth falls into line with a 'compound interest' law of development. The data obtained by various workers from growth experiments with plants from seeds which had been deprived of part of their original food reserves show that, broadly speaking, the growth and yield of the resulting plants are proportional to their initial 'food capital,' and thus provide an illuminating demonstration of this 'compound interest' law.

DEPARTMENT NEWS.

Mr. W. R. Dunlop, Scientific Assistant on the staff of the Imperial Department of Agriculture, left Barbados on January 2, by S.S. 'Campos' for Belize viâ New Orleans. Mr. Dunlop goes to British Honduras to enquire into and advise on agricultural conditions in that colony.

By the permission of His Excellency the Governor of Barbados, Revd. C. H. Branch, B.A., will act for Mr. Dunlop during his absence.

Mr. H. A. Ballou, M.Sc., Entomologist on the staff of the Imperial Department of Agriculture, left Barbados on January 6 by S.S. 'Manoa' on a visit to Dominica and Antigua in connexion with entomological investigations.

The University of London has conferred on Mr. S. C. Harland, Assistant for Cotton Research on the staff of the Imperial Department of Agriculture, the degree of Doctor of Science, in recognition of his research work, especially with reference to that on cotton.

The Times Trade Supplement, November 15, states that the Fifth International Exhibition of Rubber, other tropical products, and allied industries, which was to have been held early next year, has been postponed until June 1921.

PLANT DISEASES.

MOSAIC DISEASE OF SUGAR-CANE.

In this Journal Vol. XVI, pp. 286 and 302, Vol. XVII, p. 110) a description was given of the destructive epidemic then in progress in Porto Rico of a mottling disease of sugar-cane, supposed at that time by the investigators concerned to be new. Further information is now to hand in *Bulletin 829* of the United States Department of Agriculture, by E. W. Brandes, from which the following account is mainly abstracted; and *Bulletin 19* of the Insular Experiment Station, Rio Piedras, Porto Rico, by F. S. Earle. The disease has now been recognized to be identical with the '*gele strepenziekte*' (yellow stripe disease)of Java in which island it was described by J. H. Wakker in 1896.

History and Distribution.

The disease was known in Java in 1890, and circumstances point to its having then been present for many years. It was regarded there as due to recurrent bud variation. Elimination methods, and its operation as a factor in selection have restricted its prevalence. It occurs in Java on all types of soil and, with greater or less severity, on all kinds of sugar-cane except the wild species.

Attention was first attracted to its presence in Porto Rico in 1916, at which time it was restricted to a single district. It had then assumed epidemic form, and its spread was so rapid that in 1919 more than three-fourths of the cane-growing area was invaded.

Brandes reports the finding of the disease in Cuba, in 1919, at three separate points, at one of which it was believed to have been present for nearly twenty years. Diseased cuttings have been received from Tucuman, Argentina. In 1918 the disease was found at many places in Santo Domingo, and it has been discovered in St. Croix on cane from Porto Rico.

A survey of the cane-growing districts of the United States, made in consequence of the discovery of the disease on planting material received in Porto Rico from Louisiana, has revealed its wide distribution in Louisiana and Florida, and its occurrence in the adjoining States. The river district of Louisiana is already badly infested, the proportion of diseased plants reaching 75 per cent. on some plantations.

Losses due to the Disease.

In the districts of Porto Rico where 75 to 100 per cent. of the plants are diseased, the losses have been very heavy. The average reduction of sugar output for ten mills has been nearly 40 per cent., in spite of increased acreage, at the same time that ten mills outside the infested area have shown a slight increase. A table published in the Hawaiian Islands in 1912 showed losses due to this disease varying from 0·5 to 34 per cent. according to variety.

Symptoms.

The one marked and constant primary symptom of the disease is the peculiar mottling of the leaves, consisting of innumerable whitish or at times yellowish spots or streaks with irregular margins. The ground colour may be normal green, but more often is yellow or yellowish green. In some cases the normal colour appears only in irregular islands on a light ground. The mottling is visible as soon as the leaves unfold.

In first ratoons from infested plants a secondary symptom appears in the form of white opaque spots and streaks in the light coloured areas. These have no pigment whatever and range from pin-point spots to streaks several inches long. This white tissue remains firm and does not turn red or brown as do the pale spots caused by the feeding of froghoppers.

At about the same time or later a secondary symptom is developed on the stems, consisting in its early stages of discoloured or water-soaked patches or streaks on the internodes. These in severe cases become sunken. and longitudinal cracks may appear, causing the cane to dry out. The joints of infested canes tend to be short, and there is great loss in weight.

The general appearance of infested fields resembles the result of drought. The foliage is yellowish, and the canes more or less stunted.

Influence of External Conditions.

The disease occurs under all conditions of soil and climate. Cultivation, manuring, and the use of lime do not notably decrease its effects.

Resistance and Susceptibility.

In Porto Rico all the standard varieties, and all the local, Barbados, and Demerara seedlings are attacked. The Bourbon cane is exceedingly susceptible, and the Striped (Rayada), White Transparent (Crystalina), and Yellow Caledonia, all of which are grown in quantity in the island, are severely injured. The imported seedlings most favoured in Java show a high degree of endurance of the disease, suggesting that this character has influenced their selection. They become generally but lightly infested, and make an apparently normal growth.

Perfect immunity exists among the thin Indian or Japanese canes. The Kavangire, a cane of this class introduced from the Argentine, has been severely tested in Porto Rico without developing any symptoms of infection. Of broad-leaved canes the only ones giving indications of possible immunity are four Louisiana seedlings, but they have not yet been sufficiently tested for a definite statement to be made.

Corn, sorghum, rice, millet, crab-grass, foxtail, and Panicum have been found to be subject to infection, but are stated to be attacked with difficulty, contracting the disease when grown in the close neigbourhood of diseased cane.

Causation.

No fungus or bacterium has been found to have any causative connexion with the disease. The evidence points to its association with the affections caused by infective viruses, the existence of which is established in the mosaic diseases of tobacco, tomato, cucumber, bean, potato and other plants, and is strongly indicated in diseases of a nature more closely resembling that of the affection under discussion, such as sereh, potato leaf-roll, and curly top of beet. Comparison may also be made with a disease of man in the instance of yellow fever.

Communicability.

Cuttings from affected plants invariably reproduce the disease, and it is in this way that it has been distributed about the world. The infection of healthy strains brought within the range of the disease shows clearly that it is in some way transferable. Contact alone does not produce this result, nor is there any evidence that the infective principle resides in the soil. Healthy cuttings planted in fields or in pots from which badly diseased plants have been recently removed are not infected. The spread of the disease by infection is observed to be very erratic, rapid at one time or place, slow or absent at another. The evidence points to the existence of a carrier, probably an insect, and suspicion in Porto Rico has fallen on a leafhopper (*Tettigonia* sp.) which has been associated with rapid extension of the disease. Cases

where the disease has existed for years without becoming epidemic, as in the Cuban example quoted, can be attributed to the absence of a suitable transmitting agent.

Control.

Uninfected regions should be protected by careful quarantine, with especial caution against introduction on highly resistant varieties, which will transmit the disease without showing signs of infection in themselves.

Light infestations may be dealt with by pulling up the affected plants. There is said to be no need to burn or otherwise destroy them, as wilted plants are no longer infective.

Severe infestations should be dealt with by the thorough clearing of the fields after crop, followed by the use of disease-free material for replanting. If a rotation crop is interposed, the security will be the greater against reinfection from growing fragments of the old stools, or from weeds.

W. N.

PRODUCING STOCK FEED ON SMALL AREAS.

In a recent number of *Agricultural Extension Notes* published by the Porto Rico Agricultural Experiment Station, some valuable hints are given with regard to the best way for owners or renters of a few acres of land to raise sufficient food for the keep of a few cattle. Much of this article is reproduced below, as of general interest to stock owners throughout the West Indies

The feeding of animals, be they poultry, hogs, cattle, or horses, is a problem confronting all owners. West Indian pastures are generally poor, necessitating a far too large acreage to feed an animal. Our grains and root crops are needed for human food, and therefore not cheap when used for stock feed. Imported feeds are expensive, usually too expensive. Yet proper feeding is one of the indispensable factors without which no one can expect to make money from live stock.

The problem of the cattle owner is cheap pasture ; and that is a very serious one at present, when practically all land which will produce sugar-cane or food crops is being utilized for these purposes rather than for pasture. Those who have pasture are again confronted with the problem of keeping their animals in good condition during the dry season. The method known as soiling is one which appears well suited to West Indian conditions, and one that comes nearer solving the feed problem than any other.

Soiling means stall-feeding with green material, a method well known in Barbados, for instance. But systematic soiling means more than that. It means producing enough feed on one acre for six to eight head of stock, and it means having that feed as abundantly during the dry season as when rain is plentiful. The method is simple : have the barn or pen close to a field where the feed may be grown ; if cows, keep them in the stalls or in the pen, except for a short time towards evening, when they may be let out for exercise ; rake all the manure into a covered manure pit once or twice a day, and let the liquid manure run into a separate pit or tank ; haul the manure on to the adjoining field at least once a week, and plough it under immediately ; have a tank mounted on wheels, a large barrel or a hogshead on a two-wheeled cart will do ; fill the tank one quarter full with liquid manure and fill up with water, and sprinkle the growing crop with this mixture as far as it will reach.

It is well known that heavily manured land will produce enormous quantities of feed. The crop to plant may vary with local conditions, but any of the larger grasses, Guinea, Para, or Sudan, are generally suitable. Those grasses do not, however, furnish sufficient nourishment for a milch cow, largely because they are lacking in protein. This nutriment may be supplied by growing legumes, such as velvet beans, cowpeas, etc. A mixture of grasses and legumes, run through a cutting box and sprinkled with molasses, makes an excellent feed for cattle and horses although some grain should be supplied in order to obtain the best results.

The cost connected with soiling is very much less than most people suspect. The main points are : have the field close to the pen to save the cost of hauling feed as well as manure ; apply plenty of manure, and plant a new patch of ground every week ; have several different crops in order to supply, as near as possible, all the feed needed ; plant the crops that are known to be most suitable to the locality ; be sure to plant some legumes, they supply the very costly and very much needed protein for feed, and nitrogen for fertilizer.

Soiling is especially well adapted to small areas. The man with a couple of acres of poor land has not enough pasture for a cow. That cow can be fed in the stall. Every scrap of manure should be saved and applied to the soil in the following manner : every week open a furrow not over 50 feet long ; apply the manure and cover it up immediately. Plant one of the large grasses such as mentioned above, and hoe between the plants to keep out weeds and to keep the soil in good tilth. Every inch of ground not planted in grass or used for a kitchen garden should be planted to legumes. The legumes will usually make some growth, especially with a sprinkling of stable manure. The second crop of legumes will be much better than the first one, and in a couple of years the 2 acres will readily support two to three head of cattle. In time it will be possible to produce enough feed for some pigs and chickens also, but no one should succumb to the temptation of growing a crop of cane or corn or cotton until the land is very much improved. A large amount of naturally poor or more or less worn out soils can be made to yield profitable crops in the manner outlined ; but it takes time.

Aside from roughage, the great need is grain feed. Owners of cows usually purchase imported bran, cotton-seed meal, and mixed feeds of many different brands. There is no need for that, for the material can be produced locally. Velvet beans—seeds and pods ground up together—are a good substitute for cotton-seed meal Soya beans produce cheaper protein and fat than that obtained in the purchased feeds, shown by records in Porto Rico of yields ranging from half a ton to a ton per acre.

In an article referring to the extraction of oil from the seeds of Para rubber trees, the *India Rubber Journal* October 11, 1919, states that the area under rubber cultivation in Malaya is, approximately, 1½ million acres. The yield of seed may be taken at about 400 per tree, and assuming ninety trees per acre, the yield per acre would amount to 306 lb. This gives a total yield of 130,000 tons of seed per annum, which, on a 20 per cent. oil basis, represents 26,000 tons of oil. From an economic point of view, it would be preferable to express or extract decorticated seed.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, December 11.

BALATA—Venezuelan Block, no quotations ; West Indian Sheet, 4*s* 0½*d*.
BEESWAX—No quotations.
CACAO—Trinidad, 125*s*. to 130*s*.; Grenada, 120*s*. to 130*s*.; Jamaica, St. Lucia, St. Vincent, and Dominica, 120*s*. to 128*s*.
COPRA—£61.
HONEY—Jamaica, 80*s*. to 104*s*.
LIME JUICE—Raw, 2*s*. ; Concentrated, no quotations.
PIMENTO—6*d*.
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T S. GARRAWAY & Co., January 7.

ARROWROOT—$9·00 per 100 lb.
CACAO—No recent sales
COCO-NUTS—$45·00 husked nuts.
HAY—$5·50 per 100 lb.
ONIONS—$12·00.
PEAS, SPLIT—No quotations; Canada, Market bare.
POTATOES—$6·00 per barrel
SUGAR—Market bare.

London.—THE PERFUMERY AND ESSENTIAL OIL RECORD, November 25, 1919.

BAY OIL—18*s*.
LIME OIL—Flat, at 3*s*. 6*d*. for West Indian distilled, and 11*s*. for hand-pressed.
ORANGE OIL—West Indian sweet, 17*s*. 6*d*. bitter, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., December 9.

CACAO—Venezuelan, $26·00 ; Trinidad, $23·50 to $24·00.
COCO-NUT OIL—$1·75 per gallon.
COFFEE—Venezuelan, 23c. per lb..
COPRA—9c. per lb.
DHAL—$10·25.
ONIONS—$10·00 per 100 lb.
PEAS, SPLIT—$11·00 per bag.
POTATOES—English, $6·00 per 100 lb.
RICE—Yellow, $12·00; to $13·00 White, $12·00 per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs. GILLESPIE BROS. &Co., December 8

CACAO—Caracas, 21c. to 21½c.; Grenada, 22c. to 22½c. ; Trinidad, 22c. to 22½c.; Jamaica, 18½c.
COCO-NUTS—Jamaica selects, $80·00; Trinidad $80·00; culls, Jamaica, $55·00 ; Trinidad $55·00 per M.
COFFEE—Jamaica, 21c. to 25c. per lb.
GINGER—24c. to 27c. per lb.
GOAT SKINS—Jamaica $1·80; Antigua and Barbados, $1·75; St. Thomas and St. Kitts, $1·65.
GRAPE FRUIT—Jamaica, $2·50 to $2·75.
LIMES—$8·00. to $9·00
MACE—41c. per lb.
NUTMEGS—22c.
ORANGES—$3·00 to $3·50.
PIMENTO—9c. per lb.
SUGAR—Centrifugals, 96°, No market ; Muscovados, 89°, No market ; Molasses, 89°, No market.

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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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ORGANIC MANURES.

IT is an accepted truism that the fertility of soils depends to a large extent on the organic matter which they contain: soils deficient in this material are seldom very productive. At the same time, however, it must not be forgotten that many other factors control productiveness, notably moisture. Given adequate rain, the successful planter is he who so manages his land as to supply it with an abundance of organic matter. This must be a source of constant care and activity, for organic matter tends continually to decay, and so to disappear, and must be renewed. This decay is more rapid in the tropics than in temperate climates, for in the latter it is arrested by the low temperatures which are experienced, and entirely ceases when the ground becomes frozen. In the tropics the change goes on day and night, being arrested, perhaps, only during times of intense dryness and extreme heat, or under conditions of waterlogging or compactness of soil such as should never prevail on agricultural land. This being so, the supply of organic matter to the soil is of greater moment in tropical agriculture than it is in temperate regions, though even in the latter it is regarded as of essential importance.

Much of the poor and so-called worn out land to be found in tropical countries is in an impoverished condition, owing to the depletion of its organic matter, a condition which, in very many cases might have been obviated by forethought and sound agriculture.

How to obtain the required organic matter is the constant care of every good planter. The sources of supply are the pen manure or farmyard manure which results from the feeding of farm animals. Added to this are crop residues which are not used as fodder for animals, and crops which are grown with the distinct purpose of burying them in the soil—green dressings as they are termed; and, finally, there are the supplies of vegetable matter which can be collected from outlying areas, in the form of bush, grass, and wild growths, which are abundant in some places, though scanty in others.

Of all these the pen manure is most highly regarded by the planter: several reasons, doubtless, account for this. In the first place the

material is enriched by the excreta of the animals. At one time this was regarded as the principal cause of its value, but it would seem that there are other reasons. Later there was a change of ideas, and it was thought that the uneaten fodder should constitute an equally valuable manure as that containing the excreta of farm animals mixed with the bedding and uneaten fodder. This was virtually the idea of green dressings. While green dressings were found to be quite beneficial, they did not altogether satisfy the planter, who felt that he got better results from pen manure than from green dressings, or from bush and such like matter turned directly into the soil.

Unfortunately, in general agriculture there has been little in the nature of precise investigation—little of that weighing and measuring which are fundamental to the scientific investigation of problems; so that the development of knowledge on the subject depended on the accumulation of experience and tradition, often of a vague and uncertain character, but carrying weight as it accumulates and tends in a definite direction.

There seemed to be something connected with the farm animals which improved the quality of the material used as manure, and that something did not appear to be merely plant food as determined by chemical analysis, for the animals do not add to, but rather take from this. It is in the condition of the material that the increased value seems to lie.

The investigations of the last few years appear to supply the explanation. It is now suggested that in pen manure the organic matter is in a condition in which it mingles better with the soil, giving it those qualities which make for fertility. The vegetable matter in pen or farmyard manure is in a changing or rotting condition, which every planter recognizes as desirable, and of which he speaks with approval, well rotted manure being what he desires for application to his fields. Given abundance of this, and an adequate supply of rain, he feels that, in the absence of pests and diseases, he is assured of a good crop.

The rotting then is the thing desired. Now rotting is a definite process set up by definite organisms; it is not merely a change induced by air or water: there must be something to do the rotting. This aspect of the question has been receiving a good deal of scientific attention of late. It is now recognized that the manure heap contains an abundance of minute organisms which have the power of rotting vegetable matter, and of converting it into that state which experience has long recognized as desirable from an agricultural point of view. Vegetable fibres are recognized as amongst the most enduring of substances: linen and cotton fabrics, thread rope, and the like, will last for years, for centuries even, under some conditions ; in others they will decay rapidly : in no circumstances, perhaps, will they decay more rapidly than if they are buried in a manure heap. In the manure heap there exist certain organisms which have the power of attacking, or feeding upon vegetable fibres in a remarkable manner ; these fibres appear to be their special food, for they do not thrive on other materials. These are the planters' allies, for they convert hard, unassimilable fibre, even wood, into that soft, humus substance which mingles so well with the soil, and gives it those properties whereby it is rendered fertile.

These beneficial organisms exist in the digestive tract of farm animals, and no doubt play an important part in the digestion of the vegetable fodder on which these animals live. They are also contained in the excreta, and so find their way into the manure heap where they continue their activities. They exist in some variety, having different growth requirements. For their growth and development the most beneficial of them require air as well as moisture, a point which has recently been recognized and applied in practice.

With these facts in view, it is understandable why pen manure is more useful and gives better results than green dressings or bush ; it contains the means whereby it is, so to speak, digested and made fit for intimate incorporation with the soil. These facts appear to explain the experience of some planters, that small dressings of animal manure give results which seem to be in excess of what might be expected from the amount of fertilizing material used. Part of the value of the dressing lies in the addition of a good supply of the organisms capable of digesting vegetable fibre, and of converting it into the desired humus substances.

In these circumstances, it would seem worth while to give small applications of pen manure to land which receives green dressings, so as to ensure the adequate supply of the desired digestive organisms.

In this connexion the method of handling pen manure, described on page 411 in the previous volume of this Journal, is deserving of consideration : intelligently and energetically applied, it permits of the

quality. Large quantities of vegetable matter, in excess of the actual fodder requirements of the animals employed in its preparation, can be employed, causing a large quantity of good manure to be produced continuously under conditions where there is little loss of fertilizing material. The preparation of comparatively small heaps of manure, which are soon turned over into the receiving pit, permits of efficient aeration, and of the rotting of the resistant fibres by the organisms under discussion; while the protection from rain prevents the washing away of the valuable fertilizing ingredients which contribute largely to the value of this indispensable fertilizer.

The scientific study of the chemistry of the manure heap is now engaging attention in many important institutions. From these investigations we may expect the enunciation of many important principles having a direct and useful bearing on practical agriculture: indeed some of these are already in evidence, and reference to them will be found in the pages of future issues of this Journal as occasion offers.

A very important bit of work in this direction has already been referred to in a note in the *Agricultural News*, Vol. XVIII, p. 361, namely the success of Dr. Hutchinson at Rothamsted Experimental Station in obtaining a pure culture of an organism capable of bringing about the decomposition of straw. It must always be borne in mind, however, that the presence of such organisms, whether obtained from the excreta of animals or in the form of a pure culture, is requisite for breaking down vegetable fibres.

There is, however, one lesson which may have immediate application on the part of planters. The present is an opportune time to give earnest attention to the manner of producing and using all the vegetable matter available or capable of being economically produced. In this work attention should be given to the proper care and storage of pen manure. This may entail expenditure on stables, cattle pens, and manure sheds; but now that most crops are bringing high prices, the time is opportune for expenditure in this direction, notwithstanding the high cost of building material, for use may be made of material locally available; and, costly as imported building material may be, it will, doubtless, be well to employ it, for it will lead to increased output while values are high, and it will put the plantation into a condition of efficiency to give good returns when prices have fallen.

RACCOONS.

An enquiry has recently been made from a Natural History Museum in the United States to the Imperial Commissioner of Agriculture for the West Indies, as o the possibility of procuring at least the skin and skull of a Barbados raccoon, with the view of determining the species.

The raccoons are an interesting group of mammals, forming as they do a link between the bears and the weasels. The older naturalists, like Buffon, recognize apparently only one species (*Procyon lotor*), which was stated to range from Southern Canada in the North to Argentina in the South, including many of the West Indian islands. According to later naturalists, however, several other species are now recognized, three at least being named in the Cambridge Natural History. All the raccoons are nocturnal in their habit, and somewhat omnivorous as to their food; for although chiefly feeding on vegetables, they do not seem to disdain a certain amount of animal food, one species inhabiting the Southern United States being especially partial to oysters.

With regard to the occurrence of the animal in these West Indian islands, it would appear that it was probably introduced from the mainland at some time after their settlement, though it must have been very early in their history. Sir Hans Sloane, in his Natural History of Jamaica, published in 1725, states that raccoons were common in Jamaica in the mountains, and that they live in hollow fiddlewood trees from whence they make paths to go to seek sugar-canes which is their chief, if not only, sustenance.' In a recent book on the Bahama Islands, published by the Geographical Society of Baltimore in 1905, in the section dealing with mammals of those islands, an account is given of the local raccoon, under the specific name of *P. maynardi*. It is there stated that, though undoubtedly introduced from the mainland, and of North American affinities, it is unlike any other raccoon with which the author had been able to compare it. Though it is stated to have formally been common in the Bahamas, it is now known to occur only in the island of New Providence, where it is said to be destructive to sweet potatoes and other crops, and in fact to be a nuisance.

As to its occurrence in Barbados, although Ligon in his History of Barbados, does not mention its presence in the year 1657—in fact, with the exception of bats, Ligon does not seem to know of any indigenous mammal in this island—in the year 1750 it is noted by Hughes, in his Natural History of Barbados, that raccoons together with monkeys had become such a pest to the planters by destroying their crops that the legislature had offered a reward for each head. This would seem to show that at that time raccoons must have been numerous in the island. The efforts to destroy them must have been successful, for Sir Robert Schomburgk in his History, published in 1848, notes that, although raccoons were stated to have been very plentiful formerly in the island, they were then very rare. Since then it has often been supposed that they have become practically extinct, although no longer is a price set on their heads. Reliable information, however, goes to show that, although rare, they still exist in the ravines or 'gullies' of the island.

The Imperial Commissioner of Agriculture would be very glad to obtain a specimen of the animal, or at least of its skin and skull, for the purpose of sending the specimen to the American naturalist referred to above. The Commissioner of course will readily pay a reasonable sum for this specimen. Any information concerning the present or recent occurence of this animal in Barbados would also be welcome

CANE SYRUP OR FANCY MOLASSES.

On account of the high prices at present obtainable for all classes of sugar products, attention has been aroused concerning the manufacture of cane syrup, or, as it is sometimes called, Fancy Molasses, in some of the smaller West Indian islands where central factories do not exist, but where muscovado plants are still not uncommon.

The process of manufacture of these syrups is similar in many respects to that of making muscovado sugar, but differs from it in that special precautions are taken to restrain crystallization. Considering the present interest manifested in this direction, it seems desirable to refer to, and quote largely from, an article on the subject by Dr. H. A. Tempany, then Superintendent of Agriculture for the Leeward Islands, which was published in the *West Indian Bulletin*, Vol. XIII, p. 324 :—

The requirements of a good syrup may be stated as follows :—

(1) It should possess a density of not less than 40° Baumé ; (2) it should test not more than 48° and not less than 32° by the polariscope ; (3) it should be free from fermentation and pronounced flavour of acidity ; (4) it should evince no sign of crystallization even on prolonged standing ; (5) it should be absolutely free from all traces of mineral acid , (6) it should be clean, free from suspended impurities, bright, and of a good light golden colour.

Turning to the consideration of practical questions relating to the manufacture of syrups, it may be once more stated that the essential difference between the manufacture of syrups and that of sugar lies in the fact that in the latter case the object sought is to induce as much sugar as possible to crystallize from the concentrated cane juice, whilst in the former it is to restrain crystallization altogether. In order to secure this, it is necessary that a sufficient quantity of the cane sugar originally present in the juice should be converted into invert sugar, or, as it is more usually termed in cane-producing countries, glucose. Invert sugar possesses the property not only of not crystallizing itself, but also of restraining the crystallization of cane sugar.

In syrup-making the whole object sought is to convert a sufficient amount of cane sugar into invert sugar, to prevent crystallization in the finished syrup.

Practically any acid will effect the inversion of cane sugar, but the rate of inversion will depend on four things : 1) the strength of the acid employed ; (2) the quantity present ; (3) the temperature of the juice; and (4) the length of time of the reaction. The most rapid inversion is secured when relatively strong acids, such as the mineral acids, hydrochloric or sulphuric, are employed. The use of these reagents is, however, precluded in the manufacture of cane syrups for direct consumption. Consequently it becomes necessary to find some other reagent capable of causing the necessary inversion, the presence of which will not be detrimental to the finished syrup.

Under these circumstances, various vegetable acids suggest themselves, notably tartaric acid, citric acid, or even lime juice ; but here again it seems not unlikely that their enployment in the requisite quantity would materially increase the cost of the manufacture of syrup.

Experience has shown that fresh cane juice naturally possesses a certain amount of original acidity, and that this varies very considerably with the conditions under which the cane is grown. In the case of cane grown on light volcanic non-calcareous soils, with the accompaniment of a fairly heavy rainfall, it has been found that the natural acidity of the juice may in some cases suffice to effect the requisite degree of inversion, provided it is not neutralized by the addition of lime. Under these circumstances the securing of the necessary conditions in respect to acidity becomes a simple matter. On the other hand, this by no means holds true in all cases. For instance, it is impossible to manufacture syrups from ripe canes encountered on calcareous soils without the addition of acidity supplementary to that normally contained in the juice.

From this it would seem that by employing fixed quantities of sour juice, approximately twenty-four hours old, to effect the necessary inversion, a certain degree of control is capable of being established with comparative ease. Once this is done, there does not seem to be any reason why the same degree of cleanliness should not be observed in making syrup as in making muscovado sugar ; in fact it would seem that a practice which would involve keeping the boiling house in a sour and dirty condition cannot be too strongly deprecated, since it must necessarily involve greatly added risk of contamination of the finished product with organisms likely to cause souring and other undesirable fermentation changes in the finished syrup.

From what has been said, it is obviously not possible to lay down any hard and fast rule as to the quantity of sour cane juice which it is necessary to employ to effect inversion, since it may vary from nothing, as in the case of certain estates in the northern cane-growing district of St. Kitts, up to 60 to 80 gallons of sour juice twenty-four hours old, as has been found necessary in certain estates in the limestone area of Antigua. Consequently would-be syrup makers must determine for themselves the requirements suited to the conditions under which they are working ; this, however, need present no great amount of difficulty, since a few careful trials will soon afford the information needed.

The next point calling for consideration is the treatment of the juice after it leaves the mill and runs into the clarifier.

In the ordinary operation of sugar-making, the first step is the application of lime to the juice. Some diversity of opinion exists as to the desirability of 'tempering' in the manufacture of syrup. If no lime is added, any sour juice that may be necessary may be run direct into the clarifier, and the process of heating the clarifier conducted in the ordinary way. If, on the other hand, lime is added, it would probably be preferable to add the sour juice to the clarified juice after it has run down on the battery. If lime is added, the quantity used should be considerably less than in sugar making, not more than 1 lb. to a 500-gallon clarifier, and probably ½ lb. would be nearer the mark. The question of lime or no lime seems to be open to discussion, and it constitutes a practical point which syrup makers must settle for themselves.

Once the acid liquor has been run down on to the battery, the operation of boiling is conducted on similar lines to those of sugar-making, with the important difference that a considerably increased degree of attention must be paid to cleaning the tayches during boiling. The operation of clarification conducted by either of the above methods, suffices only to remove a portion of the impurities, and the remainder must be got rid of by persistent cleaning on the copper wall. In addition to the ordinary wooden paddles commonly used for this operation in sugar houses, the use of skimmers constructed of perforated plate, or stout trays of fine mesh wire-gauze seems desirable. On the success of this operation the appearance of the finished syrup will largely

depend ; hence too much stress cannot be laid on its importance. The end of the operation is determined when the syrup has reached the required specific gravity. This is determined by testing the hot liquor by means of a hydrometer. The instrument commonly employed in syrup boiling is the Baumé hydrometer.

As already pointed out, finished syrups should possess a density of not less than 40° Baumé cold. This is secured in the operation of boiling by continuing the concentration until the hot liquid gives a reading of 35° Baumé with the hydrometer, the difference between the hot and the cold reading being accounted for by contraction during cooling. The following tabular statement shows the approximate correspondence between the densities of hot and cold syrup :—

Density of finished syrup hot.	Density of cold syrup.
34° Baumé	39° Baumé
35° ,,	40° ,,
36° ,,	41° ,,
37° ,,	42° ,,

The possession of an accurately calibrated hydrometer is essential if syrup is to be made successfully.

In this connexion it may be suggested that a most useful vessel for holding samples of hot syrup in which to float the hydrometer may easily be made from a joint of bamboo of the requisite diameter. This has an advantage over the ordinary vessel employed for the purpose, because the bamboo joint, being of thick wood, is a good non-conductor, and thus prevents the rapid cooling which takes place when the usual metal vessel is used.

For convenience of reference the following table shows the equivalent value of Baumé degrees and specific gravity at 84° F. for the values likely to be encountered in syrup making :—

Specific Gravity.	Baumé.
1·3211	35°
1·3340	36°
1·3458	37°
1·3585	38°
1·3719	39°
1·3848	40°
1·3986	41°
1·4125	42°

A point of some importance is that syrups should not contain any appreciable amount of iron, since the presence of it causes them to be dark in colour. No doubt the use of copper vessels for boiling syrup is to be preferred to those made of iron, since thereby the risk of contamination with iron is minimized, and the production of a good light-coloured syrup ensured.

The question of storage of finished syrups is also important, and greater attention is required in this respect than is the case where muscovado sugar is being manufactured. When, as has sometimes been done, the syrups are run down into the wooden coolers—usually employed for receiving muscovado massecuite—trouble has been not infrequently experienced owing to the starting of leakages in the wood, and loss has resulted in consequence. On this account concrete or stone coolers are greatly to be preferred for the reception of the hot liquid ; it is further very desirable that reservoirs of sufficient capacity should be provided into which the syrup can be run from the coolers and stored prior to running off into puncheons for shipment. The absence of such tanks renders more difficult the operation of blending to obtain a uniform product. They are best constructed of stone masonwork or concrete, and the interior should be faced with cement, and free from cracks, since the presence of these latter affords room for harbouring bacterial and fungoid organisms likely to be detrimental to the stored syrup. They should be fitted with a satisfactory cover to prevent dust getting in, and should preferably be provided with two cocks, one at the bottom and the other about 9 inches above the bottom of the reservoir. This allows room for any fine suspended dirt to settle at the bottom of the cistern, and the clear supernatant liquid to be drawn off without disturbing it. Every precaution should be taken to maintain tanks used for storing in good condition, and before commencing crop they should be thoroughly overhauled and cleaned.

A word may be said as to packages for shipment of the product ; in this respect also careful attention is required. Not only do second-hand packages occasion risk of loss owing to their lack of strength, but an old puncheon is more likely to harbour dangerous organisms which may give rise to souring. Moreover, a sound well-coopered package seems likely to be more readily saleable than one of indifferent quality, irrespective of the merits of the contained syrup. As a measure of precaution likely to prevent contamination with dangerous bacteria, it is strongly recommended that all puncheons intended to contain syrup, should, if possible, be cleaned out with a jet of live steam before being filled.

Note on hydrometers It should be pointed out that the relationship between specific gravity and degrees Baumé given in the table above, is what is known as the Baumé old scale. A new scale is now in use in which the relationship is as follows :—

Specific Gravity.	Baumé
1·3132	35°
1·3250	36°
1·3375	37°
1·3490	38°
1·3620	39°
1 3750	40°
1·3880	41°
1·4010	42°

This information may be of service to those who may meet with discrepancies in the readings of Baumé hydrometers.

Kapok.—The vegetable staple known commercially as kapok, is a floss obtained from the pods of large trees of the botanic family Bombaceae. An article in the *Monthly Bulletin of Agricultural Intelligence and Plant Diseases*, February 1919, states that the species which supplies 90 per cent. of the world's consumption of kapok is *Eriodendron anfractuosum*, which is cultivated in the Malay Peninsula, in Cambodia, and in French West Africa. Another species belonging to the genus Bombax is common also in French West Africa, where it is known as 'faux cottonnier' or 'fromager.' It grows from the Atlantic coast to the Lake Tchad territories, both on the savannas and in the forests. The exploitation of this Bombax tree for kapok is at present restricted to Upper Senegal and the Ivory Coast. These are the only two French colonies, with the exception of Cambodia, which export this product.

COTTON.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co. on Sea Island cotton in the Southern States, for the week ended December 20, 1919, is as follows :—

ISLANDS. The market has been very quiet during the week, with very little demand. However, the Factors continue very firm in their asking prices, and are refusing to make any concessions to sell, as they think the limited supply available this season will, in time, be required by the trade.

Planters' crops of Extra Fine are firmly held at very high prices, ranging from $1·00 to $1·50, the expectation being that these crops will be required by the English and French spinners.

We quote, viz :—

Fine to Fully Fine @ 85c., f.o.b. and freight.

Fine to Fully Fine, off in preparation, @ 82c., f.o.b. and freight

GEORGIAS AND FLORIDAS. There have been a good demand for the small offerings, the buying being on account of the Northern Mills. The general feeling is that the limited supply of these qualities will continue in demand on account of the Northern Mills.

The United States Census Bureau's report of the ginning to December 13, points to a very small crop, which will fall short of the Government's estimate of a total of 15,000 bales for Georgia, Florida, and South Carolina.

We quote, viz:—

Average Extra Choice, @ 83c. to 84c., f.o.b. and freight.

The exports from Savannah for the week were, to Northern Mills 161 bales, Southern Mills 24 bales, and from Jacksonville to Northern Mills 482 bales.

The United States Census Bureau reports the amount of Sea Island cotton ginned to December 13, as follows : —

South Carolina	3,001 bales	making a total of	6,429 bales
Georgia	635 bales		
Florida	2,793 bales		
against last year,	31,060 bales.	Total crop	44,380 bales.
„ 1917	83,352 bales.	„ „	88,174 bales.
„ 1916	110,448 bales.	„ „	113,109 bales.
„ 1915	83,810 bales	„ „	85,278 bales.

PIMENTO LEAVES.

Although the berries of the pimento tree have long been one of the exports of Jamaica, up to the present time no use has been made of the leaves of the tree, which are very similar in fragrance to the leaves of the kindred species of pimento from which bay oil is extracted in many of the smaller islands.

The Times Trade Supplement, December 6, 1919, has the following note on this subject :—

A report from the Imperial Institute on a sample of pimento leaves sent from Jamaica has been published by the Government of the colony. The sample was sent to England to ascertain whether the leaves would be of value as a source of essential oil, or for the preparation of a tanning extract. The report states in part :—

'Essential oil.—On steam distillation, the leaves yielded 2·9 per cent. of volatile oil of pale yellowish-brown colour and pleasant odour ; the oil is of excellent quality, containing a high percentage of phenols. The oil was submitted to firms of manufacturers, who considered it of very good quality. One firm valued it at 14s. per lb., the price then quoted for pimento oil. Another firm expressed considerable interest in the oil, and inquired whether it could be prepared and shipped so as to be saleable in the United Kingdom at about 7s. or 8s per lb. Experiments should therefore be made in Jamaica with a view to determining tde price at which oil could be remuneratively produced for export.'

The report on the tanning value of the leaves follows. One paragraph states : 'In the event of the oil being exported to the United Kingdom it may prove remunerative to manufacture a tannin extract as a by-product for local use, as, although the material contains only a moderate amount of tannin, it is capable of producing leather of good quality. The preparation of the extract for export would not be advisable unless very large quantities of leaves are to be worked, as expensive and complicated plant (including vacuum evaporators) would be needed.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. Plant distribution during December included the following : ornamental, 33 ; budded oranges, 2; grafted mango, 1 ; onion seedlings, 5,000 ; onion seed, 1 packet ; other economic, 7 ; cuttings, 2 bundles. Regarding staple crops, Mr. W. O'Brien Donovan, Acting Superintendent of Agriculture, states that cacao pickings continue heavy, and the market holds firm. Quite recently several thousands of coco-nuts were shipped to Trinidad, and fetched, it is claimed, $80 00 gross per 1,000. The Marie Galante cotton crop in Carriacou is said to be very promising. With fair sunshiny weather, there seems to be no reason, says Mr. Donovan, why the 1919-20 crop should not exceed the production of any of the former four years. Wet muscovado sugar, which is now extremely scarce, is selling at 25*s.* per kerosene tin. Indications are that these prices will be further inflated. It is mentioned that prior to the war, this commodity sold at 8*s.* : during the war it increased to 14*s.* The officers of the Department have given aid to estate owners and peasants by directing spraying operations with Bordeaux-nicotine and soap nicotine in the endeavour to control thrips. Winners of prizes under the Grenada Prize Holdings Scheme (provisions competition) have received their awards. The District Boards of the various parishes managed the prize distribution. Hon. H. Ferguson, Colonial Secretary, who presided, presented the awards to the prize winners in the St. George's district, the prize distribution being held under the auspices of the Agricultural and Commercial Society. Warm days, cool nights, and occasional showers characterized the weather during the month. The precipitation at Richmond Hill was 5·28 inches.

DOMINICA. The crop of limes in the Lime Experiment Station for the nine months ended December 31 was 1,450 barrels, which, sold locally, realized the sum of £531 5*s.* 8*d.*, being an average return of 7*s.* 3¾*d.* per barrel. Plant distribution during the month of December comprised : limes, 6,300 ; cacao, 200 ; budded citrus, 64 ; miscellaneous, 3 ; shade tree cuttings, 200 ; cane cuttings, 1,200 ; onion seedlings, 4,700. The local price of ripe limes, Mr. Jones the Curator states, has dropped from 7*s.* to 6*s.* per barrel ; the price of raw juice remains at 10*d.* per gallon. The London quotation for concentrated juice is £38 10*s.* The local cacao market has been active during the month, good estates cacao being in active demand at 102*s.* per cwt. The steady spread of *Orthezia praelonga* on lime trees is

reported from several estates. The weather during December was fine; the rainfall for the month equalled 6·70 inches; the total rainfall for the year was 68·03 inches.

MONTSERRAT. The Curator, Mr. W. Robson, writes to say that during the month of December 2,150 lb. of bay leaves were reaped in the Botanic Gardens, making a total of 8,032 lb. for the year, and a total yield of 88 lb. of oil from the plot. The first fruits of *Momordica cochinchinensis* have ripened. The second crop of the early planted cotton is over, but on later planted areas a considerable amount of cotton is yet to be picked. The date for the destruction of old cotton plants has this year been fixed for January 31. The bulk of the 1919 cotton crop has been sold before shipment at 4*s.* 8*d.* per lb. spot cash. Cotton stainers have again done serious damage in one or two areas, and are now numerous in most localities; but planters are gratified at the small proportion of stained cotton in the crop as a whole. In this connexion the destruction of 1,700 silk cotton trees is recorded. Love Vine has been very prevalent for some months and, unfortunately, is found to be partial to bread-and-cheese hedges. The rainfall recorded for the month at Grove Station was 4·21 inches; the total rainfall for the year was 56·85 inches.

ANTIGUA. In addition to ordinary routine work in the Botanic Gardens, preparations are being made for raising new varieties of sugar-cane. Plant distribution during November included the following: onion slips, 2,300; sugar-cane cuttings, 200; cacao, 16; forest trees, 33; decorative, 11; budded oranges, 3. Referring to staple crops, the acting Curator, Mr. A. Gallwey, states that the sugar-cane crop throughout the island continues to improve; the young cane crop looks very promising in some districts. Attacks of the cotton worm on cotton plants decreased during the month; cotton stainers are still common in all cotton fields; the corn ear worm has done slight damage to the corn crop; observations in connexion with hardback beetle grubs were continued. The total quantity of seed-cotton bought to date on behalf of the Cotton Growers' Association was 9,073 lb. of clean cotton, and 271½ lb. of stained. The rainfall for the month was 2·33 inches; for the year to date, 51·14 inches.

ST. KITTS. In the Botanic Gardens usual routine work was carried on during the month of December. Plant distribution included: 600 sweet potato cuttings, 12 lb. peanuts 4,300 cane cuttings. In addition, 20,700 cane cuttings were sold The prospects of the cane crop for the coming season have improved, Mr. Shepherd writes to say, and there is every promise of a good return It is estimated that the Sugar Factory will make 12,000 tons of crystals. The canes are green and vigorous, and present a very healthy appearance. The young cane crop is being rapidly planted, the acreage under the Barbados seedling B.H.10(12) is on the increase. The cotton crop is all practically reaped, except where a second picking is being taken. Nearly the whole of the St. Kitts crop has been sold to Mr. H. F Wildy at 4*s.* 9*d.* per lb. spot cash. Cotton stainers have not increased. It is hoped that the destruction of their native food-plants will be continued on the lines of last season. The rainfall for the month was 5·37 inches; for the year 52·96 inches.

VIRGIN ISLANDS. Mr. C. A. Gomez, Curator, Tortola, writes to say there has been a brisk demand for onion seedlings, and during December last, approximately 100,000 were distributed to onion growers in Tortola and Virgin Gorda. Cotton fields, under the influence of the fair weather conditions experienced, are giving satisfactory returns. Seed-cotton, approximating 70 bales of 250 lb. of *lint* each, has been received, ginned, and baled at the Government Ginnery. Some peasants are holding up stocks of cotton in the hope that the Government will remove the ½*d.* per lb. export tax on cotton sold to the Station; while other growers, especially in Virgin Gorda, are preparing sloop loads for shipment to St. Kitts, where they receive 8*d.* per lb. for seed-cotton as compared with 7*d.* per lb. in Tortola. Sugar works have been busy all over the island, but have failed to meet the people's demand for sugar, of which commodity there is a great scarcity. The Station works handled a small lot of peasants' canes, and the sugar made, met with a ready sale. The cotton worm (*Alabama argillacea*) made its appearance in isolated fields of cotton late in the month; *Dysdercus* sp. have been very plentiful in all districts. The present Curator assumed duties on December 15. Seasonable weather prevailed during the month, the rainfall being 5·77 inches. The total rainfall for the year was 50·38 inches.

AGRICULTURE IN BARBADOS.

December closed with a very satisfactory rainfall in the northern half of the island, but in the southern part, and particularly in Christ Church, there was a great scarcity of rain. This year, during the early hours of the second day, a most refreshing rain fell in the southern and south-western portions of the island, just where it was needed most.

It is surprising to see how yellow some fields of the B. 376 have turned during the past month. This seedling has evidently had its day. It came to the rescue of the planters at a critical time, and was their friend during several adverse years. It has not been lightly given up, but, year by year, as will doubtless be the case with other seedlings, it has given signs of departing vigour.

The B.6450, which is being spoken of as a deteriorating seedling, is now growing rapidly, and some fields are demonstrating that, with liberal treatment, this seedling may be patronized yet awhile. It is a soft cane, and like the B. 208, the rats find it much to their liking. It should not be reaped this season as early as either the B.H.10(12) or the Ba.6032.

At the present time we stand in need of an experimental station in the red soil. Splendid work has been done at the existing station, but the requirements of the whole island cannot be met by experiments carried on at a single spot. The information gained cannot be applied in general for, although the island is very small, there are marked differences both in soil and rainfall.

The spring of the young crop is reported to be, on the whole, good. The last planted fields of B.6450 have not germinated so well in those districts in which there was a shortage of rain in December, but everywhere the other seedlings have made a regular start.

The fields in which cultivation has been completed look well. A larger amount of draining has apparently been done in the red soil this season, and the moulding of brows is in progress on many estates. All this is excellent work. It greatly assists in the fertilization of the soil, and consequently aids in the resisting of a drought.

Not only will the yam crop be reaped later this season, but the return promises to be smaller than was anticipated at an earlier date. The supply of potatoes has kept up better than was expected, although there is a scarcity in some districts. The favourable weather has enabled planters to put in many fields of fall potatoes, and these have made a good start. (The Barbados *Agricultural Reporter*, January 10, 1920.)

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

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†*Provided by the Imperial Department of Scientific and Industrial Research.*

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NOTES AND COMMENTS.

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The production of cane syrup or fancy molasses is dealt with in an article on page 20.

The difference in value in the types of basic slag at present procurable is discussed in an article on page 26.

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Sesbania Seeds.

The nutritive value and possible uses of the seeds of a species of Sesbania from South Africa have been investigated at the Imperial Institute, and reported on in the *Bulletin* of the Institute, Vol. XVI, No. 2.

The genus Sesbania, one of the Leguminosae, includes a number of shrubby annuals found in the tropics and sub-tropics of both hemispheres. Several of them are found in the West Indies, one (*Sesbania aculeata*), is not uncommon in Antigua for instance. This is probably the species the seed of which from South Africa has been examined by the Imperial Institute. It is stated that the farmers in South Africa regard this Sesbania seed as an excellent poultry food.

The results of the analysis show that the Sesbania seeds contain a high percentage of protein, and about 6 per cent. of oil. They compare favourably in composition with other leguminous seeds, such as field beans and peas. The seeds yielded no prussic acid. Their small size and hard coat are to some extent disadvantages, but apart from this they have a high food value.

It would be interesting to know whether Sesbania seeds have ever been utilized for feeding poultry in the West Indies.

The Scientific Survey of Porto Rico and the United States Virgin Islands.

In 1913 the New York Academy of Sciences, in co-operation with the Government of Porto Rico, the American Museum of Natural History, the New York Botanical Gardens, and the scientific departments of Colombia University and other institutions, began an investigation of the geology and natural history of Porto Rico, which was subsequently extended to include the United States Virgin Islands.

The *Journal of the New York Botanical Garden*, November 1919, notes that the first part of the first volume of the final reports of this survey was published on September 26, 1919. It contains: (1) History of the Survey by Dr. N. L. Britton, (2) Geological Introduction by Professor C. P. Berkey, and (3) Geology of the San Juan district by Dr. Douglas R. Semmes.

The final reports on the botany of the survey will take the form of a descriptive and annotated flora, the first part of which it is proposed to publish in 1920.

These reports will doubtless be of standard value to students of geology and natural history throughout the West Indies.

Composition of Trinidad Avocados.

An exceedingly instructive article on the avocado in Trinidad and Tobago, by Mr. W. G. Freeman, Director of Agriculture, appears in the *Bulletin of the Department of Agriculture*, Trinidad and Tobago, Vol. XVIII, Part 3.

An interesting point is brought out in the fact that avocados grown in Trinidad contain much less oil than those grown in California and Florida. Mr. H. S. Shrewsbury, acting Government Analyst,

shows by analysis that the richest in oil of the Trinidad varieties was the 'River' which gave 7·6 per cent. of oil, more than 2 per cent. less than the minimum oil content of any of the twenty-eight different varieties analysed by Mr. M. E. Jaffa in California.

One of the varieties grown in Trinidad is the 'Trapp' avocado, a budded plant of which was received from the United States Department of Agriculture. Mr. Jaffa gives an analysis of this variety grown in California in his series; consequently a good opportunity was afforded for comparing the oil content of fruit of the same variety grown in Trinidad and in California.

In California the 'Trapp' yields 9·80 per cent. oil. In Trinidad the fruits of the 'Trapp contain' only 2·5 per cent. of oil. This remarkable difference is probably attributable to the different climatic and cultural conditions.

Fustic Wood.

Among the natural dyes which, like logwood, have never been completely displaced by synthetic compounds, is that produced from the wood of the fustic tree (*Maclura tinctoria*), indigenous to the West Indies. This is used to produce a yellow dye largely employed in producing the khaki shade or colour for woollen and cotton goods. According to a note in the *Journal of the Royal Society of Arts*, November 28, 1919, the shipment of the wood to the United States for dyeing purposes is an industry which has developed considerably in the last couple of years in Trinidad. Previously most of the fustic used in the United States is said to have been imported foom Mexico, but it is claimed that the Trinidad product is of superior dye strength. The report of the United States Consul in Port-of-Spain shows that Trinidad exported 168,000 lb. of fustic during 1918 to the United States, of the value of $1,880, and that during the first three months of 1919 an almost equal amount had been shipped.

The fustic tree, known in some of these islands as Bois d'Orange' is not only a dyewood, but also affords excellent timber of unusual durability. The wood is much used in the smaller islands by wheelwrights for the construction of naves and felloes. The average size of a tree fit to produce the commercial product would be about 5 feet in circumference at about 3 feet from the ground.

It is stated that fustic trees are to be found in abundance in the Government forests along the southern coast of Trinidad, and also in the island of Tobago to the north.

Old Names and New.

The way in which the modern school of American botanists has been changing the old recognized names, not only of specific and generic, but even of the orders of plants, has been a source of puzzlement, not to say irritation, to men of an older school.

These feelings are rather amusingly expressed by W. F. Massey in a note published in the *Southern Planter*, November 1, 1919. Referring to a volume published by the Department of Agriculture, United States of America, on the flora of the district of Columbia, he says he finds that the nomenclature of the common native and introduced wild plants has been so entirely changed of late years by the modern American botanist that old fellows like himself are completely at sea.

Hair-splitting differences, he remarks, have been taken as reasons for upsetting, not only species and genera, but orders. No longer have we Leguminosae; they are now Fabaceae. Just why, no one but a Washington botanist could tell. The name Leguminosae is surely more descriptive than Fabaceae derived from the name of a single genus. A legume or pod describes a great many genera, Faba does not. Just as well call them 'Foolaceae.'

Botanical names have been latinized as a common language, so as to make the name the same in all modern languages. It is hardly possible that European botanists are going to follow a nomenclature heretofore unknown outside of Washington and the New York Botanical Garden.

Sugar Substitutes.

In drawing attention to the persistent efforts that are being made at present in the United States to amend the regulations of the Department of Agriculture with regard to the inhibition of employing saccharine in food products, *Facts About Sugar*, November 15, 1919, points out that a great amount of confusion is evident in the discussion of so-called substitutes, the production of which has been stimulated by the shortage in the market supplies of genuine sugars. Strictly speaking none of the products are genuine substitutes for sugar. Either they are lacking in food value, or in the characteristic flavour of pure sugar.

Saccharine, which is a coal-tar product, though it is from 300 to 500 times sweeter than sugar, is not a food. It not only has no vestige of food value, but is regarded by many chemists as a deleterious drug, and it is on this ground that the Federal Authorities forbid its use in food products.

Syrups made from maize and sorghum, for instance, have an actual food value, though of a different character from that possessed by sugar. On the other hand, the flavour of these syrups is far less attractive than pure cane or even beet sugar, so that sugar is usually combined with them when they are employed in manufacture.

The distinction between saccharine and glucose syrups is clear. The latter may be objected to from the point of taste, but the use of the former ought to be prohibited for the sake of public health. Saccharine in fact has no other proper use than as a medicine, to be carefully employed in the treatment of certain complaints.

ENTOMOLOGISTS' VISIT TO THE WEST INDIES.

In the previous issue of the *Agricultural News* attention was drawn to notes of the entomologists attached to the expedition sent out from the University of Iowa to Barbados and Antigua in 1918, which were published in recent numbers of the *Canadian Entomologist*. That article dealt with their visit to Barbados. The expedition spent the month from June 19 to July 19 in Antigua. The following is gleaned from Mr. Stoner's notes on that island.

He says that owing to the fact that Antigua is not so thoroughly cultivated as is Barbados, and that natural enemies of insects are not numerous, a more abundant and varied insect fauna is found there.

Of the lower forms of terrestrial Arthropods, scorpions and tarantulas, as well as other forms of Arachnids, are abundant. Under dried leaves numbers of a large brachypterous cockroach were found. Centipedes too are not uncommon in moist places. In addition to the large cockroach above mentioned, two other forms, *Periplaneta australasiæ* and *P. americana* are also very common. A greater variety of both Acridiids and Locustids was secured here than at Barbados, the large *Schistocerca pallens* being among them, which also was found in Barbados.

There are few fresh-water streams or ponds in Antigua. One of these ponds, however, situated near the dockyard at English Harbour, where the headquarters of the expedition was situated, was made the subject of a rather intensive study. Among the more interesting forms of insect life found there was a mole cricket (*Gryllotalpa* sp.) which had not been discovered at Barbados. Many other groups were represented in the pond, such as dragon-fly and damsel-fly larvae and adults, and various species of dipterous larvae. Such ponds afford excellent breeding places for mosquitoes, and great numbers of both larvae and pupæ of these were found.

The low grassy lands towards the centre of the island furnish a great variety of insects, particularly Hemiptera add Orthoptera.

Mr. Stoner was struck in walking through woody districts by the great number of what appeared at first to be stems of climbing vines on trees. Upon closer examination it was discovered that these apparent stems are really the covered galleries through which the termites, locally known as 'wood-ants,' travel from place to place. These tunnels are seen every where, winding about over trunks and branches of trees, and usually terminating in a nest of some size, either on the ground, or in the trees themselves. The termites are usually sightless, and being adverse to the light, construct tunnels when it becomes necessary to cross an exposed surface. The nests and tunnels are made of pellets of chewed wood, fastened together with sticky saliva secreted by the insects. When thoroughly dry the nests are very tough and resistant, being of about the consistency of hard rubber; the galleries, however, are much more fragile. Both nests and galleries after a short exposure to the elements become greyish in colour.

An interesting locality in which the entomologists found insects was in the large epiphytes, locally known as 'wild pines,' which grow sometimes in great numbers on the trees in the woody districts. Upon carefully removing one of these pines from the tree to which it is usually only loosely attached, and turning it upside down, numbers of spiders, scorpions, beetles, and cockroaches were sure to be found. The bases of the large leaves of this plant form receptacles for rain-water, and both larvae and adult mosquitoes were not uncommonly found in such situations.

Among the commonest insects of Antigua are cotton stainers (*Dysdercus* spp.), of which Mr. Stoner considers that two or three forms occur on the island. Adults and also nymphs in all stages of development were taken in late June and early July, particularly along the edges of cultivated fields, and in open places near woods.

Other kinds of Hemiptera, both Homoptera and Heteroptera, were taken in great numbers from grasses and bushes in the cultivated and partly cleared areas all over the island In fact the hemipterous fauna exceeded that of any other group of insects, both in variety and abundance. One of the principal families of Heteroptera represented is the Pentatomidae, of which more than fifteen species were taken. A colony of the beautiful steel-blue and red *Vulsirea nigrorubra* was found on a small tree.

Cleared spaces in and near woods afforded good collecting grounds for butterflies, and great numbers of gaily coloured Hesperids, Nymphalids, and Lycaenids were found in the neighbourhood of the little cultivated patches.

In cultivated fields along the hills great numbers of larvae and adults of the boll worm (*Heliothis* sp.) and the cut worm (*Prodenia* sp.) were found. These insects do some injury to various plants, including corn and sweet potatoes. In such places also Chrysopa larvae and adults were very common. Small Chrysomelids are not uncommon, *Homophæta æquinoctialis* being one of them.

Very often moths of different kinds, attracted by the light, were captured within doors at night, the most notable of these being several forms of Protoparse and a specimen or two of the interesting noctuid *Erebus odora*, locally called 'black witch'.

With few exceptions, large, striking, or bizarre forms of insect life do not occur on either Barbados or Antigua.

As soon as the material secured has been put into proper shape for examination, Mr. Stoner states, it will be submitted to specialists for detailed study and report. The Antiguan material is much in excess of that secured in Barbados, owing to the larger variety of insect fauna occurring in the former island.

QUALITY OF BASIC SLAG.

The following note from the *Journal of the Board of Agriculture*, November 1919, is of particular interest now that supplies of chemical manures are once more becoming obtainable for agricultural purposes :—

Numerous enquiries are made as to the difference in value of the different grades of basic slag. There are three distinct types of slag, which must on no account be confused :—

1. Bessemer slag containing phosphoric acid equivalent to 40 per cent or more of tricalcic phosphate, largely soluble in 2 per cent. citric acid ; usually 80 per cent. of the total is guaranteed soluble.

2. Basic 'open hearth' slag containing less phosphoric acid, equivalent to 15 to 31 per cent. of tricalcic phosphate, largely soluble (80 per cent.) in 2 per cent. citric acid, the first pourings being richer than the last.

3. Basic 'open hearth' slag made by the use of lime and fluorspar, containing as much phosphate as the poorer grades of the preceding class, but only slightly soluble (20 per cent. or less) in 2 per cent. citric acid.

The first of these types, the Bessemer slag, is the material which for many years was well known to agriculturists as one of the most effective of fertilizers for pasture land. The second and third types have come into prominence in recent years, and especially during the war, as the result of changes in the method of making steel. At first sight they are not very promising agriculturally, but field experiments have shown that they possess distinct value. The second class have proved substantially equal in fertilizer value to the old Bessemer slags when compared on equal phosphate content. The third class have proved more effective than was at first assumed from their low solubility in citric acid. Where the growing season has been sufficiently long, these slags are approximately as useful as the others, in spite of their low solubility. Where the growing season is shorter, or an early start more necessary, the high soluble slags have proved more effective.

The question has recently been raised whether a 40-per cent. slag is worth a high price in comparison with a 20-per cent. slag. It is sometimes claimed that the 20 per cent. slag is as good as the other in nine cases out of ten, and that there is, therefore, no point in paying an excessive price for slag which may be no better. This assumes that the value of the slag lies not in its phosphates, as is usually supposed, but in some other constituents. There is insufficient evidence to say whether other constituents do or do not help the growing crop, and it is always possible that they may do so. There is no doubt a good deal to be learned about these new slags, and investigators have not yet had the necessary time to test them as thoroughly as is desirable. On present knowledge, however, it is safest to adopt the old plan of judging the new slags, like the old, on their phosphatic content, and buying them on their value according to the unit system, insisting on the proper degree of fineness of grinding.

EXPERIMENTS IN YAM CULTIVATION IN TRINIDAD.

In the *Agricultural News*, Vol. XVII, p. 197, attention was drawn to a series of experiments conducted in Trinidad by the Agricultural Department with regard to problems of yam cultivation. During the season of 1918-19, the previous year's experiments at St. Augustine Experiment Station were repeated. The conclusions arrived at are recorded in the *Bulletin of the Department of Agriculture*, Trinidad and Tobago, Vol. XVII, Part 3, by Mr. Joseph de Verteuil, Superintendent of Field Experiments, and Mr. L. A. Brunton, Assistant Superintendent.

With regard to the experiment as to yield of the three varieties, Barbados Libson, Horn, and Red yams, the results of the previous year were confirmed, the Libson again proving the most prolific yielder, having given 15·25 tons per acre against 9·33 tons for the Red, and 4·66 tons for the Horn yam.

With regard to the selection of plants, as to whether it is preferable to use the top, centre, or bottom portions of the tubers for planting purposes, the results of the previous year were also confirmed, showing that it can safely be concluded that there is no advantage in selecting any special part of the tubers for planting.

With a view of ascertaining the correctness of the statement 'that a large plant gives a larger yield than a small plant,' duplicate plots were set out with plants ¼ lb, ½ lb, and 1 lb. each, respectively. As far as the yield is concerned, the results are not quite conclusive, but they seem to show that there is no advantage to be gained in using larger sized plants than ¼ lb.

In order to determine some points with regard to the method of planting, such as :—

(1) Is it more profitable to plant in holes or in trenches ?

(2) What is the best planting distance ?

(3) Is it necessary to have large holes filled with trash or manure ?

(4) Is there any advantage in staking the vine ?—experiments were conducted by digging trenches 4 and 3 feet apart, and planting at distances of 1 foot, 18 inches, 2, and 3 feet apart respectively. Holes were dug 4 feet by 3 feet, 4 feet by 2 feet, 3 feet by 3 feet, and 3 feet by 2 feet, respectively. Another set of holes was dug 2 feet by 18 inches wide, but only 8 inches deep, at a distance of 4 feet by 3 feet and 3 feet by 3 feet apart; trash and manure were applied to one half of these holes, whereas no trash or manure was put in the others, which were simply refilled with loose earth, and the soil drawn up in a hill. The results obtained show that, notwithstanding the higher cost of preparing deep holes, it is more profitable. It is also concluded that it is more profitable to fill the holes with trash and manure, as the value of the larger yield obtained is more than sufficient to pay for the extra cost.

As regards the planting distance, the results again confirm the conclusions reached the previous year. A larger yield is obtained with close planting; the most convenient distance at which planting can be made in holes is 3 feet by 3 feet; the best distance for trenches is 3 feet apart in which the plants may be put at any distance from 2 feet to 1 foot apart At these distances the largest yield has been obtained.

Whether trenching is more profitable than holing does not admit of a definite conclusion. Trenching is more expensive than holing, but, as it permits of closer planting a higher yield is probably obtained. With trenching also the land is better prepared for subsequent crops, especially if the untrenched portion of the first year is worked up for the second year.

The opinion has been expressed that staking is essential in Trinidad to obtain a large crop of yams, the idea being that in such a damp climate the vines would rot, especially if injured in weeding or moulding, if allowed to run freely on the soil. With the object of ascertaining the correctness of this opinion, two plots were tried this year without staking, compared with two plots where the vines were staked. Although the results were not conclusive, they tend to show that as large a yield may be obtained without staking as from staking the vines. As the cost of staking is by no means negligible, it may be found to be more profitable to dispense with it.

It is stated that observations at the Taunus Observatory, near Frankfort, about 2,600 feet above sea-level, where the mean annual rainfall is about 39·4 inches, show 66 per cent greater precipitation annually under trees than in the open. (*Experiment Station Record*, September 1919.)

GLEANINGS.

The *Louisiana Planter*, December 13, 1919, states that the Experiment Station at Audubon Park, New Orleans, has been asked to pay a rental of $1,000 per annum after March 1, 1920, and two years thereafter to remove the station from there. The Commissioners of the park are said to have so notified the Experiment Station officials this week.

Never in the history of the world has a flourishing industry received such a catastrophic blow as the beet sugar industry in France received by the war. In 1913-14 the number of factories in operation was 206, with a production of 714,400 tons; in 1918-19 the number had been reduced to fifty-one, with a sugar production of 110,000 tons. (The *Louisiana Planter*, December 6, 1919.)

Of the 500 species of bamboos known, there are only a few to be found on the African continent, the most important species being in reality an Asiatic one (*Bambusa arundinacea*). This large bamboo is much used in Africa, but less so than in Asia. The natives use it for building huts and making tools; they sometimes use the seed for food, and the leaves as fodder for their stock. (*Monthly Bulletin of Agricultural Intelligence and Plant Diseases*, February 1919.)

The preliminary report of the systematic investigation last winter, by engineers appointed by the Government, of the water-power resources of India has recently been issued. While the data collected are admittedly incomplete, the facts gathered give a striking impression of the enormous potentialities of the development of hydro electric power possible in India. The report states that an estimate of 1,774,000 electrical horse-power in sight is vastly below the actual power which the final results of the survey will show.

A note in the *Journal of the Royal Society of Arts*, November 21, 1919, calls attention to the prickly pear pest in Australia. An area of over 20,000,000 acres is stated to be infested with prickly pear in Queensland, and over 2,200,000 acres in New South Wales. The rate of increase of the pest is estimated at 1,000,000 acres per annum, and in a short time the land infested is rendered unproductive and valueless. The plant is extremely difficult to eradicate, and no satisfactory machine for destroying it has yet been invented. It has been suggested that it might be utilized for the manufacture of alcohol, paper, or potash; but the fact that prickly pear contains such a large percentage of water makes its profitable commercial utilization very unlikely.

It is stated that the Director of Agriculture, Jamaica, has submitted a proposal to the Government of that island for the establishment of a condensed milk factory there. Jamaica imports at least £300,000 worth of condensed milk each year, and it is considered that something should be done towards manufacturing the article locally. Experiments by the Agricultural Department in producing samples of condensed milk have been attended with success. (*The Times* Trade Supplement, December 13, 1919)

A letter from a correspondent to the *Western Morning News*, December 15, 1919, points out that banana growing could very easily become a flourishing industry in the West African colonies, particularly in Sierra Leone. The writer points out that both the dwarf Canary banana, and the larger Jamaica variety—the two varieties best known on the English market—grow as well in the West African colonies as in the Canary Islands or in the West Indies, and that with shipping facilities to the English market, the supply of fruit could be almost unlimited.

Owing to the great scarcity and the consequent high price of rice in Japan, it was necessary to import all the supplies of this foodstuff that it was possible to obtain during the year 1919. On account of the shortage of rice, the Government is doing everything possible to get people to use wheat-flour and other substitutes instead of rice, but it is rather a slow operation to induce a people, that have for ages past lived almost entirely on rice, to give it up for flour or some other grain. (*Weekly Bulletin*, Department of Trade and Commerce, Canada, December 1, 1919.)

The first thirty cane seedlings produced at the Tucuman Experiment Station, Argentina, in the first few months of 1917, were harvested in the month of May 1918, and again the cane from cuttings harvested in 1918 were harvested in June 1919. The results of the experiments are given in the *Revista Industrial y Agricola de Tucuman*, Vol. IX, Nos. 11 and 12. Efforts are being made to produce varieties of known parentage, and a number of nurseries have been established of plantings of the different varieties from which it is desired to produce crosses.

Facts About Sugar, November 22, 1919, states that advices from Prague, viâ French wireless service, under date of November 19, announce that arrangements have been completed between France and Czecho-Slovakia for the delivery to France of 100,000 tons of sugar, at a price stated to be 2,100 francs per ton, i. e. only a little less than 1 franc per lb. This statement is of interest; first, because it appears that the sugar producing area of central Europe is beginning to recover from the effects of the war; and secondly, as showing what high price France has to pay for its sugar supply.

Whether silage has an effect in causing milk to sour quickly has been debated amongst dairy farmers for some time. With the idea of clearing up the question, tests were carried out on the Research Farm by the Department of Agriculture, Victoria, during the last three weeks in August 1919. The result was that no increased acidity was perceptible in the case of milk from silage-fed cows over that of cows which received no silage. The conclusion therefore is, that silage does not cause milk to sour more rapidly. (The *Journal of the Department of Agriculture*, Victoria, Australia, October 1919.)

A NOTE ON A PECULIAR TYPE OF 'ROGUE' IN SEA ISLAND COTTON.

In 1915, the attention of the writer was attracted to an aberrant type of plant occurring sporadically in commercial fields of Sea Island cotton in St. Vincent. It differs from normal Sea Island in two main features. The size of all the vegetative parts is much smaller, and there is a degree of sterility which is complete on the male, and almost complete on the female side. The anthers have never been observed to contain viable pollen. The partial sterility of the ovules leads to the shedding of practically all the young fruits, and since shedding has the effect of stimulating vegetative growth, a characteristic habit is induced in the plants. The main stem is thin and wiry: many of the fruiting branches abort after producing one or two nodes, and the plants remain in flower long after their neighbours have ceased.

This type of plant is known among the labourers as 'man cotton.' It constitutes a perfectly definite morphological type, quite distinct from Sea Island, and occurs to the extent of about 1 plant per 2,000 in all commercial fields.

Observations in 1915-18 led to the belief that no viable seeds were ever produced by the rogue, for during these four years all the young fruits were shed when three or four days old. This shedding took place even when the flowers were pollinated from neighbouring Sea Island plants.

In August 1919, the writer observed in St. Kitts a 'man cotton' which bore a single fruit containing one seed, and subsequently found a plant in St Vincent bearing a single fruit with two seeds, both of which germinated when planted. The resulting plants were normal Sea Island in appearance Since no pollen is produced by the rogues, these two plants represent the first generation of a natural cross between rogue and Sea Island.

It will be of interest to see whether, in the next generation, segregation will occur into normal and rogue in the simple 3:1 ratio.

In strains of Sea Island cotton at the St. Vincent Experimental Station which have been selfed for four years, the rogue type occurs, though rarely. The history of the occurrence of one series of rogues may be alluded to.

In 1916, a progeny row containing sixty plants was grown from a single selfed plant. All were normal. In 1917, two selfed plants of the above culture were grown in progeny rows, fifty plants of each. All the plants were again normal. In 1918, the strain was continued from one of the selfed 1917 plants. All the sixty-two plants were normal. These sixty-two plants were all selfed, and cultures grown from all in 1919. The typical 'man cotton' appeared in four cultures. the proportions being, respectively, 1 rogue to 112 normal, 2 rogues to 53 normal, 1 rogue to 47 normal, and 1 rogue to 92 normal. We have here a case of the sudden appearance of a mutant in strains of self-fertilized ancestry. The occurrence of 'man cotton' as a mutant from the normal type is analogous to the mode of origin of mutants in *Oenothera lamarckiana* Attention may be directed to the fact that some of the Oenothera mutations such as *lata*, are characterized by complete male sterility.

S. C. H.

COTTON IN NIGERIA.

The cotton industry, both with regard to the cultivation of the plant and the manufacture of the product, is the subject of a special section of *The Times* Trade Supplement, October 25, 1919. This section is full of interesting matter. We reproduce a few paragraphs on the possibilities of extended production in Nigeria :—

The cultivation of cotton for export in Nigeria is quite insignificant in view of what it can ultimately attain if an intelligent policy is pursued. The British Cotton Growing Association has done tremendous work, but the extension of that work and the fruition which the labours of the Association deserve would have been marked with more promising results, had there been in Nigeria a properly equiped Agricultural Department in the first eight years of their venture. Even now the exiguous equipment of the Agricultural Department is sadly incommensurate with the vast possibilities that lie before the development of the natural resources of Nigeria.

In the Northern Provinces of Nigeria, the localities in which cotton growing is receiving expert attention and encouragement are favourable enough, but the industry is subject in these spheres to an economic competition from a crop for which there is an increasing European demand, namely, the ground-nut crop. This valuable product, which never appears to approach the limit of overproduction, commands from European mercantile houses trading in the vicinity of the Baro-Kano Railway increasingly high prices. Cotton, moreover, is subject to a fixed purchasing price with very small range of expansion, and has had, on occasion, to receive preferential freight rates on rail and steamer, in order not to lower the price paid to the grower, and thereby discourage his efforts. There is also no speculative buying of cotton as in the case of ground-nuts. Again, a competing market is found in the extensive local weaving industry. The price paid to the grower leaves a very small margin over the cost of production compared to the startling figures paid for the ground nuts. Cotton is also a hazardous crop, peculiarly subject to parasitic disease, and in a locality like Hausaland, is periodically threatened with total failure through inconstant rainfall.

In the Hausa States of Nigeria cotton has been cultivated from the earliest times. The weaving industry of Kano and Zaria has exported its woven cloth as far north as Tripoli by caravan, and to this day it is in great demand in all the markets of Hausaland and throughout Southern Nigeria. To satisfy this demand from native looms, a very appreciable portion of the cotton crop is deverted to local purposes. The energies of the British Cotton Growing Association have been in great part devoted to improving the short staple and lustre of the cotton indigenous to the country, and to inducing the farmer to give cotton a place in the crop rotation. The climate of the country, though subject to cycles of drought, is generally favourable to its growth. The population is dense and, remarkably industrious, though there are large land areas still uncultivated.

It is impossible to state in figures even approximately correct the present annual cotton production of this region, but one can gather some estimate that its volume is not insignificant from the fact that the native production supplies cloth to the inhabitants of North Central Africa.

While we are crying for cotton and still more cotton, here is a territory with every natural advantage for its growth in large quantities, which a very small outlay would bring within reach of European markets.

AN IMPERIAL BUREAU OF MYCOLOGY.

The second meeting of mycological workers in India was held at Pusa in February 1918, under the chairmanship of Dr. E. J. Butler. The important subject of the establishment of an Imperial Bureau of Mycology on the lines of the existing Bureau of Entomology was discussed, and according to the report of the proceedings, the following resolution, which appears to be of far-reaching significance for the Empire as a whole, was passed :—

That this meeting is of opinion that an Imperial Bureau of Mycology would be of the greatest value to plant pathologists in India, if it is organized on somewhat similar lines to, but naturally independent of, the existing Imperial Bureau of Entomology, and has as its chief functions :—

(1) The organization of a system for the prompt identification of all injurious fungi for Departments of Agriculture and other similar bodies :
(2) The publication of a periodical for summarizing current literature on plant diseases, British and foreign :
(3) The preparation of classified lists of reference to past and current literature of plant diseases, and the establishment of a reference library open to consultation by plant pathologists :
(4) The answering of inquiries from plant pathologists.'

In speaking on the subject, the chairman, Dr. Butler, said that with regard to the first of these—the identification of injurious fungi—he imagined that there would be general agreement that this was one of the most important matters in which the Bureau could be of assistance. He need only give two instances from his personal experience of the great value of work of this nature, apart altogether from the advantages of being able to have their specimens named for them.

The fungus *Fomes semitostus*, B., originally described from the Khasi Hills in India, was recorded some years ago as one of the most destructive parasites of the Hevea rubber tree. At that time he was engaged in preparing the schedule under the Destructive Insects and Pests Act, and at first sight there appeared to be no reason to take precautions against the introduction of this fungus into India, since it had been originally collected in this country. But he was assured by Mr. Anstead that he had not seen a case of attack in his wide experience of rubber estates in South India, and accordingly the fungus was listed, though with some hesitation. Shortly afterwards it was established by critical examination at Kew, that the rubber parasite was not *Fomes semitostus* at all but *F. lignosus*, Kl., a fungus not known to occur in India up to date. Had it not been listed, the free importation of rubber stumps from countries where it occurs would very probably have added another and a very serious disease to those of our Indian rubber plantations.

The other case is that of pink disease, which is a very widespread and dangerous parasite of a large number of cultivated plants In the East it was described as being caused by *Corticium salmonicolor*, whereas a very similar disease, also called pink disease, was known in the West Indies and attributed to *Corticium lilacinofuscum*. He was instrumental in getting good material of both these diseases submitted to expert examination by scientists who made a special study of the genus, and they were found to be identical. The very considerable literature and practical experience in the two hemispheres was thus made available to workers in either.

These were cases where the existing facilities in Great Britain were sufficient to enable the difficulties to be cleared up, but it is certain that there are many others in which it would not be possible to get reliable advice in England at present.

Even in the mycological herbarium at Kew, which was the chief herbarium in Great Britain, the collections of tropical parasitic fungi were inadequate, and had not kept pace with the great development of tropical mycology during the past twenty years. It was practically certain that the best centre for the new Bureau was Kew, but it would be their first duty so to supplement the existing collections as to make them representative of the fungus flora of the colonies, and especially of those in the tropical and sub-tropical zones. For this, the co-operation of all would be required, though it would be advisable to be as moderate as possible in their requests for identifications, until a large collection of named species had been built up.

With regard to the second point—the publication of an abstracting journal—he was bound to say that he personally regarded with some alarm any addition to the already unwieldy mass of periodical literature dealing with plant diseases.

The third point—the formation of a library and the maintenance of classified lists of references to literature—is one on which, he imagined, all would be agreed. There was already at Kew a magnificent botanical library, and with this as a foundation, the addition of complete series of agricultural and other less strictly botanical publications in which the literature of their subject was at times found would not present any great difficulty.

The fourth point—the answering of enquiries regarding matters in which plant pathologists were interested—was perhaps not of very great importance outside the directions referred to above. Most enquiries will presumably be in regard to identifications or literature references.

Outside of these four lines of activity, there was the big question whether the Bureau should directly engage in research in connexion with diseases of Indian crops and other plants. He held very strongly that practically all such research could best be conducted on the spot. Even where the same crop was affected by the same disease in England and India, investigators could not gain more than general principles from work conducted elsewhere. Their application must be made under local conditions. Practically every colony of importance had now its own research institute and expert staff, and it was better to increase the research workers actually on the spot than to spend money on research in England with a view to applying the results in other countries, such as India.

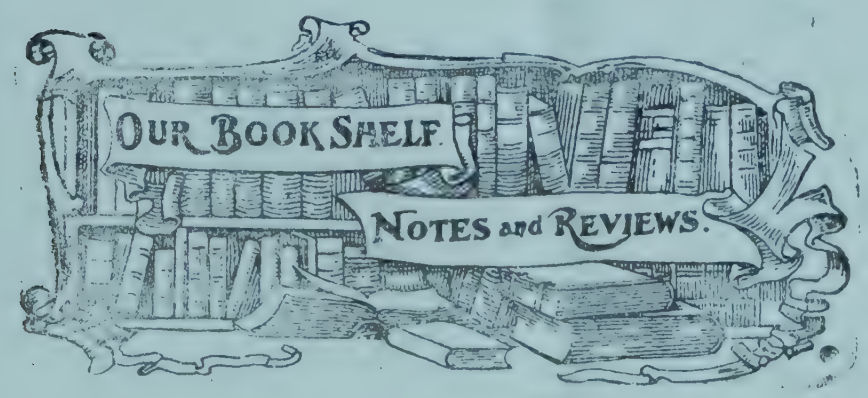
The case was quite different when the position of the colonial mycologist home on leave was considered It might well happen that he had work in hand which he could carry on at home, and there would be every advantage in providing laboratory facilities for such workers.

It would obviously be of advantage if the Bureau arranged to keep in touch with research workers in England and the colonies, so that in case of need the Bureau would be able to advise where to obtain the temporary services of an expert on some particular matter of urgency outside the capacity of a local department to deal with.

It was not yet known how far the proposed Bureau would expand. One of the subjects down on their programme was the application of the science of genetics to the control of plant diseases. This opened up a most important side of the work of the plant breeder, and, since general principles in this matter are as yet far from being fully devel-

oped, and work in any one country was likely to serve as a guide to workers elsewhere, the hope might be expressed that the Bureau would be the means of directing the attention of the plant breeders in England and elsewhere more closely to the question of breeding for disease resistance.

There was no doubt that other useful fields of activity would be found as the Bureau gained in experience, and economic mycologists in the Empire were brought more into touch with one another than in the past. He thought that he had shown that the foundation of an Imperial Bureau of Mycology was likely to be of the greatest service.



SCIENCE AND FRUIT GROWING, BEING AN ACCOUNT OF THE RESULTS OBTAINED AT THE WOBURN EXPERIMENTAL FRUIT FARM SINCE ITS FOUNDATION IN 1894. By the Duke of Bedford, K.G., F.R.S., and Spencer Pickering, M.A., F.R.S. *Macmillan & Co.* London, 1919. Price 12*s.* 6*d.* net.

This book, as its title proclaims, is not an ordinary manual of fruit growing, but is a connected account of the results obtained at the Woburn Experimental Fruit Farm during the work of a quarter of a century. This experimental station was established in 1894 by the Duke of Bedford and Mr. Pickering, in somewhat unusual circumstances, as recorded in an article in *Nature* of September 19, 1895, which is reproduced in the preface. The main object of the Farm has been the scientific investigation of problems connected with horticulture, and especially those connected with the culture of hardy fruits.

Many very interesting and important investigations have been the outcome of of the work of this station: the results have in many instances been remarkable. While the work has mainly had reference to the cultivation of such fruit trees as are grown in a temperate climate, the general principles investigated in many cases are of fundamental importance, and of world-wide application. Nor are they applicable to fruit growing alone, but they have direct bearing on many problems met with in arable agriculture.

In these circumstances the book is one which can be cordially commended to the attention of agriculturists the world over; it certainly should provide stimulating reading for planters, and for workers in the agricultural departments in the West Indies.

The book is divided into thirty-one chapters, in which are set out and discussed the results of twenty-five years' experiments. These results have formed the subject of the reports issued annually from the Farm, but as these reports are not, as a rule, readily accessible to general readers, particularly to those resident in the colonies, the summary of them in the present volume is very welcome.

The several chapters deal with problems connected with the various operations of a fruit farm, including trenching, planting, pruning, manures and manuring, the use of insecticides and fungicides, and allied matters. All these are treated from the point of view of the investigator, and not that of the routine cultivator, consequently every line is stimulating and suggestive. The second chapter, devoted to a discussion of the measurement of results, will be read with interest by everyone concerned with the difficult question of recording the results of experiments connected with orchard crops, a matter which has a bearing on the experiments with cacao, limes, coco-nuts, and similar crops, which are of interest in this part of the world.

The chapters on heated and treated soil, the effect of grass on trees, the possible cause of the grass effect, the toxic action of one crop on another, and on the behaviour of plants in masses, contain the results of a great number of experiments for which the Woburn Station is well known: the results in many cases are of great interest, and sometimes startling. The authors adduce strong evidence of the presence of toxic substances in soil, and their production by growing plants. Many of their experiments are of a very striking nature, and are such as may be readily repeated by experiment station workers elsewhere. In this connexion the opinion is expressed that the effect of heating soils, which has been the subject of experiment at Woburn, Rothamsted, and other places, is due, at least in considerable part, to the production of toxic substances by the action of heat, in contradistinction to the views of other writers, that the effect is due to the influence of heat on the microscopic organisms in the soil. These questions are of importance to planters in all countries, and are not confined to fruit growers in temperate climates. Their discussion in the compact form in which they are now presented will be appreciated by a large circle of readers.

The views held by the writers in regard to the manner in which fruit trees may advisedly be planted, have been discussed by West Indian workers on more than one occasion; they are here discussed at some length, and experimental evidence is given concerning them. They will doubtless be read with renewed interest in the form now presented, and should have the effect of causing additional observations to be made. This should lead to an increase of knowledge of the behaviour of transplanted fruit trees under the conditions obtaining in the West Indies.

Few books on agricultural subjects have appeared of late years which are likely to prove as stimulating as the one under review. The writers have boldly attacked a number of vexed questions in a proper scientific spirit; some of their conclusions are startling to orthodoxy, but they are supported by evidence carefully and honestly attained. They must, therefore, have the consideration which they merit, and it is certain that their discussion will lead to increased knowledge, and a widened outlook in many directions connected with agricultural science, not only in relation to fruit growing and orchard work, but in arable cultivation as well. It is hoped, as it is expected, that the book will be widely read.

Dr. R. D. McLaurin, formerly Professor of Chemistry in Saskatchewan University, has drawn attention to the enormous amount of potential power in the great quantity of straw produced each year in Western Canada. Experiments have shown that a gas can be obtained in large quantities from straw, and that this gas can be utilized in the same way and for similar purposes as coal gas. It is computed that the straw at present not utilized in Western Canada amounts to some 20,000,000 tons. (*Journal of the Royal Society of Arts*, October 10, 1919.)

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, December 11.

BALATA—Venezuelan Block, no quotations; West Indian Sheet, 4*s* 0½*d*.
BEESWAX—No quotations.
CACAO—Trinidad, 125*s*. to 130*s*.; Grenada, 120*s*. to 130*s*.; Jamaica, St. Lucia, St. Vincent, and Dominica, 120*s*. to 128*s*.
COPRA—£61.
HONEY—Jamaica, 80*s*. to 104*s*.
LIME JUICE—Raw, 2*s*.; Concentrated, no quotations.
PIMENTO—6*d*.
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T S. GARRAWAY & Co., January 21.

ARROWROOT—$9·00 per 100 lb.
CACAO—No recent sales
COCO-NUTS—$45·00 husked nuts.
HAY—$5·50 per 100 lb.
ONIONS—$14·00.
PEAS, SPLIT—No quotations; Canada, Market bare.
POTATOES—$6·00 per barrel
SUGAR—Market bare.

London.—THE PERFUMERY AND ESSENTIAL OIL RECORD, November 25, 1919.

BAY OIL—18*s*.
LIME OIL—Flat, at 3*s*. 6*d*. for West Indian distilled, and 11*s*. for hand-pressed.
ORANGE OIL—West Indian sweet, 17*s*. 6*d*. bitter, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., January 6.

CACAO—Venezuelan, $26·00; Trinidad, $23·50.
COCO-NUT OIL—$1·75 per gallon.
COFFEE—Venezuelan, 21c. per lb..
COPRA—10c. per lb.
DHAL—$12·00 to $13
ONIONS—$10·00 per 100 lb.
PEAS, SPLIT—$12·00 per bag.
POTATOES—English, $6·00 per 100 lb.
RICE—Yellow, $12·00; to $13·00 White, $12·00 per bag.
SUGAR—American crushed, no quotations.

New York.—Messrs. GILLESPIE BROS & Co., December 30

CACAO—Caracas. 21c. to 21½c.; Grenada, 20½c. to 21c.; Trinidad, 20½c. to 21c.; Jamaica, 18c.
COCO-NUTS—Jamaica selects, $65·00; Trinidad $65·00; culls, Jamaica, $45·00; Trinidad $45·00 per M.
COFFEE—Jamaica, 20c. to 25c. per lb.
GINGER—22c. to 26c. per lb.
GOAT SKINS—Jamaica $1·70; Antigua and Barbados, $1·55; St. Thomas and St. Kitts, $1·55.
GRAPE FRUIT—Jamaica, $1·50
LIMES—No market
MACE—40c. to 41c. per lb.
NUTMEGS—26c.
ORANGES—$4·25
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SUGAR—Centrifugals, 96°, No market: Muscovados, 89°, No market, Molasses, 89°, No market.

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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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INADEQUATE SUPPLIES.

THE editorial of the *Agricultural News* January 26, 1918, just two years ago, drew attention to a remarkable speech made a few months before by Mr. Prothero, then President of the British Board of Agriculture, on the subject of peace and scarcity. Reference to that speech will show that it was almost prophetic with regard to the conditions at present existing, one may very reasonably say, all over the world.

The nations of the world have nominally desisted from warfare for more than a year, and yet they are almost all feeling the effects of scarcity of supplies, especially of food, in spite of peace. The prices of all commodities, far from being lowered to anything like the pre-war standard, are continually advancing. This is notably the case with regard to articles of food, and the reasons for this condition of affairs are not far to seek.

Before the war, international commerce caused mutual interchange of foodstuffs among the countries of the world. Now, however, vast productive areas of some of the most fertile land in Europe have been completely destroyed, and a considerable time must necessarily elapse before the cultivation of these tracts can be restored to anything like its former condition.

It is evident that this must be the case because of the necessary shortage of labour, due to the slaughter or crippling of so many thousands of able-bodied men; and besides this, there is the want of necessary machinery, both for agricultural and industrial purposes, which it will take some time to replace. Again, the land in question must have deteriorated from lack of tillage and insufficiency of fertilizers. The world's production therefore of food is not at all likely to supply adequately the demands of the world's population for some time to come.

The reasons above given for inadequate supplies indicate some causes which will doubtless gradually be overcome by human energy and perseverance, but in looking forward there are factors which may have great influence on the world's supplies, which are beyond man's power to suppress. If, for instance, in addition to the present demand for food in the devas-

tated parts of Europe, there should be a drought or a famine in some great food-producing areas such as India, or Australia, another big drain on the world's stock of food would result. Such occurrences have happened again and again in the past, and may happen at any time in the future. Dear as bread and meat and sugar and clothes are now, they would probably, in case of such an event, become still dearer.

To consider the position from the standpoint of these West Indian islands, it would appear that, although the price of living, owing to the dearness of necessary supplies, has tremendously gone up, yet, because the chief commodities contributed by the West Indies to the world's supply have also increased in price, on the whole these islands are more flourishing than they have been for many years past. Sugar, cotton, cacao, coco-nuts are all fetching prices which would hardly have been credited five years ago. The population, however, of the West Indies cannot maintain existence on these staple products. Should supplies of breadstuffs be unobtainable at any time, the position would be very serious.

Such a situation has already arisen in Russia. Instead of supplying other lands with wheat, internal disorder has produced a bread famine which must be relieved from outside sources.

There is one thing possible to be done as a precautionary insurance for the future, the necessity of which has been urged repeatedly in the pages of this Journal. The precautionary measure which ought to be taken in all these islands is to increase the local production of foodstuffs. It is true that the present market value of sugar, cotton, and other commodities naturally induces planters to devote all their land and energy to producing the crops that appear to guarantee the greatest pecuniary returns nevertheless it is quite possible for planters, whose principal crop is cane or cotton, to produce as catch crops or rotation crops very much more food than is done at present. Moreover the value of these food crops is to be weighed as against the cost of imported materials, and the difficulty of paying for them.

The original settlers in the West Indies certainly did far more in this direction than their descendants do. In turning over the pages of an old book, such as Ligon's History of Barbados, one is struck by the manner in which the planters of the seventeenth century managed to support themselves and their labourers so very largely—one might almost say entirely—as regards necessary articles of food, on the produce of their plantations, in addition to the growing of crops, such as sugar-cane and tobacco for export as a source of pecuniary profit. It would appear that their descendants might profitably follow their good example.

The necessity of looking forward in this matter of food-supplies cannot be too strongly urged. Food is the fundamental necessity of life, and if food becomes scarce, or the price of it becomes so high as to place the obtaining of a sufficiency of it outside the reach of the majority of the inhabitants of any country, there will be discontent, as the inevitable consequence.

This question, namely the supply of locally grown foodstuffs at reasonable prices to the local population, is engaging the attention of thoughtful persons in many of these islands. In Jamaica, for instance, the planters have recently resolved to reserve a sufficient quantity of sugar manufactured in the island to supply the estimated local need, and to sell it for local consumption at a price considerably below the present outside value. At a recent meeting of the Barbados Agricultural Society, it was pointed out that the high rate of exchange was increasing the price of foodstuffs imported from the United States and Canada, placing such food more and more out of the reach of the ordinary labourer. The seriousness of this situation was emphasized, and the grave necessity for all landowners to keep the island much better supplied with locally grown foodstuffs was urged. In conclusion it was suggested that an embargo might well again be placed by the Government on the exportation of sweet potatoes and such like vegetables.

For the public good—one might really say for the public safety—it is the duty of all landowners in these islands to grow, along with the crops intended for export, as much of food crops, such as sweet potatoes and yams, corn and beans, and to sell these at a reasonable rate, as will allay the present feeling of anxiety for the future.

The product known as tea oil is not produced from the genuine tea plant (*Thea sinensis*) but is pressed from the seed of a kindred species (*T. sasangua*) of the same genus. It is a shrub common as a wild plant in some districts of Central China. The oil is used to adulterate colza oil, and is employed by Chinese ladies as a dressing for their hair. The refuse cake is a good fertilizer, and when applied to rice fields, it is said to destroy the earth worms which often attack the young rice plants. (*Monthly Bulletin of Agricultural Intelligence and Plant Diseases*, February 1919.)

ANTIGUA SUGAR FACTORY.

The fifteenth ordinary general meeting of the Antigua Sugar Factory (Limited), was held in London on December 18, 1919, when Mr. G. Moody Stuart, Chairman of the Board of Directors, presided. Before presenting the Directors' report, which is dealt with on another page of this number, the chairman gave a review of the company's history and progress, much of which is reproduced below. He said that the company has now completed the period of fifteen years covered by its agreement with the Government, and it was fitting to review its history and progress during the time. The island and, he might add, the shareholders in the company owe a debt of gratitude to three men connected with the Government for the initiation of the scheme which resulted in the incorporation of the company in 1903, viz., Mr. Joseph Chamberlain, Secretary of State for the Colonies at that time; Sir Gerald Strickland, the then Governor of the Leeward Islands; and Dr. Watts, now Sir Francis Watts, of the Imperial Department of Agriculture. It was Dr. Watts who first brought forward the proposals for a central factory, and supported them with information as to the work done elsewhere by modern factories, and with data which he had accumulated regarding the conditions of sugar-cane in Antigua. Sir Gerald Strickland surmounted the obstacles which are too often found insurmountable in such a case, and Mr. Chamberlain, when the proposals came before him, said that if private persons, plantation-owners and their friends, chose to venture their money, he would approve of the Government giving a grant-in-aid to a pioneer factory to show what could be done, so that if that succeeded other factories could follow, established on ordinary business lines. An agreement was accordingly entered into between the Government and this company, and the following is a brief summary of the work undertaken and accomplished under it:—

(*a*) The Government provided £15,000 and the company £25,000, making a total of £40,000, for the erection of a factory to make 3,000 tons of sugar in the season. The factory was duly erected, the actual cost being £45,358, approximately £15 per ton of sugar capacity. It made its first crop in 1905. It has since grown to 10,000 tons sugar capacity, and the total cost to capital account has been £103,229, or £10 6*s.* per ton. (*b*) The Government stipulated for fair co-operative terms for the original contracting planters, and that, at the end of fifteen years, shares representing half the value of the factory should be made over to these. They have received high prices for their canes, the rate averaging in recent years over 9 per cent. on the f.o.b. price of sugar. These planters are now to have their shares, representing £51,615, transferred to them free of charge. This result has come from their being not only contracting planters, but also because of their being placed in the position of shareholders in respect of the £15,000 subscribed by the Government. (*c*) The Government also stipulated for fair rates for canes from peasant growers, and these have received about double the rates previously ruling, and now it is proposed to place them on a higher scale of payment for their canes. (*d*) The subscribers of the £25,000 have received for the whole period an average of 20 per cent. annually on their capital; they have had their capital repaid in full, and they hold shares representing half the value of the factory, or £51,615, and further, they have approximately £18,000 standing at their credit in the company's books. (*e*) Another large section of the planting community has also profited by the factory, and the factory has profited by it—namely, the owners of plantations in the surrounding districts who have joined as new contractors. These have been paid on terms which have included sharing in half profits of each year's working account. The prices for their canes have compared favourably with prices paid elsewhere, their average in recent years being equal to over 7 per cent. on the f.o.b. price of sugar. These new contractors do not receive shares in the company, but now that the capital outlay hast been liquidated, the rate for their canes is to be 5½ per cent. on the price of sugar, *plus* share in half the profits, which should give them a substantial increase of what they have had hitherto.

It may be pointed out that the Government has also received a good return on its grant of £15,000, for the company's payments in England for excess profits duty have amounted to £44,476, and £16,951 in the island in export tax imposed because of the war, say, together, £61,427, and both the home and colonial Governments have profited also in other ways by the company's work.

The funds which have brought about the above-mentioned results have come from the extra sugar produced by the work of the factory, as compared with that of the old muscovado boiling-houses. These boiling-houses in Antigua took at least 15 tons of cane (many of them much more) to make one ton of sugar. The canes delivered to the factory in these fifteen years have amounted to 928,791 tons, which in the muscovado boiling-houses (on the 15-ton basis) would have given 61,919 tons sugar. Instead of that, these canes in the factory have yielded 100,012 tons sugar. There has been produced 38,093 tons extra sugar, value £431,300 net—that is after deducting cost of manufacture. It is out of this that the good rates for cane have come to the original and new contracting planters, the good return to shareholders and to the Government, the liquidation of the total cost of the factory, and better pay rendered possible to estate staff and labourers.

The results are due in the first place, to the sound basis on which the work was planned, and then to the improvement in the quality and the increase in the quantity of the work as the years went on. In the first three years the factory took 10 tons of cane to make one ton of sugar, which was just the rate calculated on in advance. Its work steadily improved, and during the last three years it has taken less than 9 tons to the ton of sugar. In the first three years the output averaged 2,737 tons, in the last three years 9,586 tons. The improvement in the work gave over 10 per cent. more sugar, costing nothing, and this, combined with more than trebling the quantity, has changed a success into a great success.

It used to be said by some in the island that it was a pity to see money taken out of the island. They thought money paid for interest or dividend to investors outside, who provided plant and machinery, skilled experts, and direction, was money taken out of the island. But the very opposite to that is nearer the truth. Sugar worth £431,300 has been raised by the factory, not by the planters, and the factory has handed over more than half of that to the planters, and less than half to the investors and the home Government combined.

STORAGE OF MANURE AND FLY SUPPRESSION.

The fly menace to human health has frequently been the subject of comment in previous volumes of the *Agricultural News*. As is well known, flies lay their eggs in manure heaps in great quantities ; there the larvae find food, and the pupae are developed. In agricultural communities however, the preservation of stable manure is of prime importance. Any method therefore, whereby manure may be adequately stored, and yet flies be prevented from breeding in it, is worth consideration.

An article by Mr. Charles K. Brain, M Sc., which appeared in the *Journal of Economic Entomology*, June 1918, drew attention to the measures which were taken with these objects at the huge Transport Depôt established in Natal during the war, and the success attained.

Although these operations were conducted on a huge scale, it would appear that similar success would be attained by similar measures in dealing with even small amounts of farmyard manure. Accordingly much of the article referred to above is here reproduced :—

During the existence of the Transport and Remount Mobilization Depôt, which was established at Durban, Natal, in November 1915, in connexion with the military operations in German East Africa, approximately 100,000 animals, mostly horses, mules, and donkeys, passed through the depôt, and the average number maintained during most of the time was about 3,300, with a maximum at any one time of 10,000. The chief interest, entomologically, lies in the fact that, althongh this depôt was situated on reclaimed swamp within fifteen minutes' walk from the centre of the town, it has not caused the slightest inconvenience to the inhabitants, and there has been an entire absence of smell and house-fly nuisance.

It may be remarked that the climatic conditions of Durban are admirably suited to the rapid multiplication of house-flies, and the question of successfully storing large deposits of stable manure in close proximity to towns and camps has always been a difficult one, but one of particular importance.

The means employed for fly control consisted of constant attention to the collection of dung, none being allowed to remain for twenty-four hours, the systematic storage and packing of manure, and continuous spraying with poison bait and contact insecticide.

Every day the manure and litter from stalls and paddocks were swept up and carted to huge trenches previously prepared in the sand dunes. These trenches were dug to a depth of about 10 feet, i.e., down to the clay layer sublying the sand. They were often 20 feet wide and 50 to 70 feet long. The carting was done by a special staff of sixteen natives under a non-commissioned officer. The average amount was approximately 150 to 160 Scotch cart loads per day. This was spread out in the huge trench until a depth of about 1 foot was reached, when other boys proceeded to cover it with a thin layer ($\frac{3}{4}$ inch) of sand, ashes, or earth. It was arranged that in carting fresh material, it was necessary to pass and repass over the manure already spread, so that it became well pressed down, and, as new layers were added, each day's deposit received its coat of sand, and afterwards its rolling or ramming down. When a trench was filled it was covered with a layer of a foot or so of earth or sand, and then thoroughly rolled for two or three days. Disinfectants or lime were added. This method of storing produces a dense, peaty mass of manure, which analysis shows to be of particularly good quality.

For sweeping manure from the stalls, hard brushes were used ; and although the work was thoroughly done, there was always a number of flies around. To deal with these, four natives under a 'conductor' were constantly treating them with a contact spray. The mixture used consisted of —

Caustic soda	2 lb.
Boiling water	50 gallons
Paraffin	5 ,, added whilst hot
Hycol	5 ,, ,, ,,

An attempt was made with this actually to hit the settled flies, and it was found that a broad-bore garden syringe was more effective than an ordinary spray pump.

Fly bait consisting of —

Arsenite of soda	5 lb.
Black sugar	5 to 20 lb.
Boiling water	25 gallons

was distributed on blue gum branches, and pieces of sacking. These were placed in all latrines, dormitories, cook houses, and stores, and were constantly renewed.

That the means adopted proved effective is well illustrated by the fact that on no occasion was the least inconvenience caused by the close proximity of the large number of animals in the depôt, nor by the thousands of tons of stored manure.

With regard to the above fly bait, the amount of arsenite seems excessively high. The usual quantity recommended for 25 gallons of water and the requisite amount of sugar would be about $2\frac{1}{2}$ lb., and as this quantity kills efficiently, there would seem to be no useful purpose in increasing it. Too high a proportion of arsenite is reported by some workers to act as repellant, defeating the purposes of a bait.

THE CENTENARY OF THE ROYAL BOTANIC GARDEN, TRINIDAD.

Mr. W. G. Freeman, B.Sc., the Director of Agriculture, Trinidad, contributed to the Christmas number of the *Trinidad Guardian*, 1919, an interesting article on the above subject, some paragraphs of which we reprod uce below :—

The Trinidad Royal Botanic Gardens at St. Ann's, Port-of-Spain, have this year entered upon the second century of unbroken existence. There are very few Botanic Gardens in the British Dominions over seas which can boast of so long a life. Some were founded before these, it is true, but for one reason or another they were abandoned, or allowed to fall into decay, to be revived in some cases at a later date when their value was once more appreciated. The Garden of St. Vincent is a noteworthy example, because it was the first of the British tropical gardens, and was drawn upon to start the Trinidad Garden. It was abandoned after some sixty years of activity, and was re established after a resting period of about another sixty years. Jamaica founded the Bath Garden in 1774, eight years after the St. Vincent one : this also was subsequently abandoned, and restored to some extent. In the East, the Garden at Penang in the Straits Settlements was started in 1800 ; but had a chequered history, being abandoned and restored more than once. The present Singapore Garden dates from 1878.

Two gardens which have already reached their 100 years are Calcutta, founded in 1786, and Sydney, New South Wales, 1816. Peradeniya, Ceylon, the successor of earlier gardens in the low country will reach its century in 1921. Botanic Gardens are, however, not comparatively new developments. In Europe the old monastic institutions maintained gardens to provide pulses, vegetables, fruits, etc, and also medicinal plants.

The Royal Botanic Gardens of Kew, to which the colonies owe so much, not only for the plants, but also for the trained men it has distributed, arose as a Physic Garden. Fostered by King George III and Sir Joseph Banks, Kew rapidly grew in importance as a centre of botanical activity.

The Gardens in Trinidad were established in the year 1818, in the time of Sir Ralph Woodford, the Governor, under the direction of Mr. Lockhart. Many of the plants were imported from Caraccas and St. Vincent.

It appears that attention was specially given during Mr. Lockhart's incumbency to the introduction and cultivation of the various spice trees.

Under the fostering care of Lord Harris, for many years Governor, the gardens flourished, and their area was considerably extended. It is said that he annually expended from his private purse a large sum towards their development.

Mr. Purdie succeeded Mr. Lockhart in 1846, through the recommendation of Sir William Hooker.

He was succeeded by Dr. Crueger, a collector and scientist of no mean repute.

In 1864 Mr. Henry Prestoe succeeded Dr. Crueger, and during the next twenty-two years he did much to maintain and increase the reputation of the gardens.

Mr. J. H. Hart was appointed in 1887. He rescued the Herbarium from decay, and put it into good order. St. Clair Experiment Station was added in 1898, and much attention given to economic work, including plant diseases and pests.

Mr. J. B. Carruthers, who succeeded Mr. Hart, unfortunately only held office for a very short period, during which he devoted himself with much zeal to encouraging Para rubber cultivation in the colony.

The garden, therefore, has been in existence 100 years, and is consequently the oldest Botanic Garden which has been continuously maintained in working order within the British West Indies.

The principal work of the Garden has been to introduce, test, and if satisfactory, to distribute plants of economic value or of ornamental worth.

DEPARTMENT NEWS.

Mr. J. C. Moore, Superintendent of Agriculture, Grenada, having resigned his post, owing to ill health, has retired on pension.

Mr. R. O. Williams, Curator of the Royal Botanic Gardens, Port-of-Spain, Trinidad, who has been appointed to succeed Mr. Moore, arrived in Grenada and assumed his duties on January 18.

Messrs. Stevenson and Roberts, Agricultural Cadets, Grenada, having completed their first year's instruction at the Grammar School and the Botanic Station, have been placed on two estates for practical work, in accordance with the new cadet scheme in that island.

CHAULMOOGRA OIL.

Considerable attention has been of late directed to the drug known as Chaulmoogra oil, and enquiries have been made of the Imperial Commissioner of Agriculture for the West Indies, whether there are any plants existing in the West Indies of the tree from the seeds of which this oil is derived. As far as is known, there are none such at present.

Mr. A. E. Collens, Acting Superintendent of Agriculture for the Leeward Islands, has recently forwarded some notes on the subject, from which the following is chiefly derived.

The oil is expressed from the seeds of two different trees: (1) *Taraktogenos Kurzii*, which grows in Burma and parts of Assam; (2) *Gynocardia odorata*, which also grows in the same parts of India. The oil obtained from the first of these trees is yellowish in colour, with an odour of rancid butter, and according to the British Pharmaceutical Index, this is the genuine Chaulmoogra oil. The oil prepared from the seeds of the other tree is of a brown colour, with an odour resembling painters' varnish. This is not considered now-a-days to have much therapeutic value.

The interest attaching to Chaulmoogra oil is because of its reputed effect in the cure of leprosy, for which purpose it has been employed in India for very many years. Whether the internal and external application of this oil really can effect a permanent cure seems somewhat doubtful, but it appears to be an established fact that its employment, if persisted in, affords more or less relief to the patients.

ANGOSTURA BITTERS.

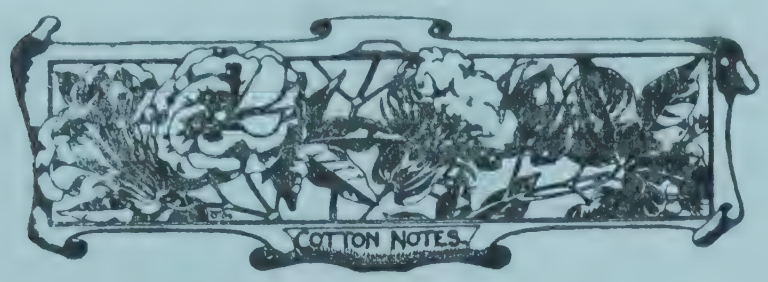
An important industry of Trinidad is the manufacture of Angostura bitters, the island having a monopoly of this specialty, which is exported to all parts of the world. An article in the *Journal of the Royal Society of Arts*, December 26, 1919, states that in 1917 a total quantity was exported of 22,667 gallons, valued at some £24,000.

The inventor of Angostura bitters was Dr. Johann Siegert, a Prussian, who went to Venezuela in 1820 and settled in Angostura, now known as Ciudad Bolivar, on the Orinoco, where he devoted special attention to the study of tropical herbs and plants possessing medicinal value.

Dr. Siegert at first prepared for the use of himself and his friends what he called 'aromatic bitters,' but in 1830 he began to manufacture the bitters on a commercial scale, the first export to England taking place in that year. The bitters became known to the trade as 'Angostura,' from the name of the town where they were first made. In 1875, on account of political disturbances in Venezuela, the place of manufacture was changed to Port-of-Spain, Trinidad.

Angostura bitters are manufactured after a secret formula which has been safely guarded by the descendants and successors of Dr. Siegert; it would appear that the preparation has never been successfully imitated up to the present. The bitters are understood to consist of a mixture of certain aromatic and carminative vegetable substances, with alcohol added as a preservative and solvent. Their best known use is as an ingredient in 'cocktails' of all kinds, though they have a medicinal value in fevers and intestinal troubles, and as a tonic.

The bitters are also much used now-a-days to flavour such beverages as lemonade, ginger beer, ginger ale, and even mineral waters. A beverage, said to be of value in the treatment of various tropical maladies, is Angostura barley water, made by adding a dash of bitters to a teaspoonful of barley, the juice of one lime, 2 tablespoonfuls of granulated sugar, and 2 pints of boiling water.



COTTON NOTES.

COTTON PLANTING IN THE TURKS AND CAICOS ISLANDS.

An article on the agriculture and industries of the Turks and Caicos Islands, which appeared in the *Agricultural News*, January 10, 1920, noted the apparently promising prospects of a future cotton industry in the Caicos group. More recent information on this subject appears in an interesting article printed in the *Gazette*, Turks and Caicos Islands, December 27, 1919.

The Caicos group of islands extends for a distance of 50 miles from east to west, embracing many islands, some of which are little inferior in size to such an island of the Lesser Antilles as St. Vincent. They are seldom visited by Europeans, and the inhabitants have long eked out a precarious living by sponging and conch fishing. The islands, which, like all the Bahamas, are flat, have long been regarded, even by those familiar with them, as utterly unsuited for agriculture.

The geology of these islands is simple. They consist entirely of coral rock, with a thin vegetable mould. The annual temperature varies between 61° and 89°F., and the annual rainfall averages from 30 to 40 inches. As was noticed in the article in the *Agricultural News* referred to above, the attention of the Commissioner, Mr. G. Whitfield Smith, was drawn in 1915 to an apparently indigenous cotton plant, and the early efforts made in the direction of encouraging its cultivation were related in the same article. Since then, however, it is considered that the peasant cultivation of cotton will produce about 30 bales for the crop of 1920. One great difficulty in extending the cultivation has been that of getting the cotton to the English market, owing to lack of transport facilities. In July 1919 an effort was made to ascertain the condition of the American market with regard to this type of cotton.

A small sample of the staple was submitted to a leading textile specialist of New York, who reported that the fibre was quite as strong and as good as Peruvian, and that the length of the staple was excellent.

The immediate result of such an encouraging report was that a body of American capitalists at once concluded the lease of 8,000 acres of land on Middle Caicos, and planting operations on a large scale are already in process.

With the view further of ascertaining definitely the value of this cotton when placed commercially on the American market, a small bale of 130 lb. was consigned to a well-known cotton dealer in New York, who was instructed to sell it on its merits. The result was very encouraging. Notwithstanding the handicap that this bale had to face—having to be sold as a loose lot or sample—it fetched the very respectable figure of 70c. per lb., with the remark from the dealer that in large lots such cotton would fetch a higher price.

The result of the appearance of this excellent quality of cotton on the New York market was that an application was immediately made by another American capitalist for the purchase of 7,000 acres of Crown lands for the purpose of cotton planting.

There the matter now stands. The outlook for this industry in the Turks and Caicos Islands is of a most hopeful character. Only time and perseverance, combined with sound and careful management, are now necessary for the successful development of the scheme which appears as if it would lead to the regeneration of the Caicos Islands.

The cotton lint has up to the present been obtained in the Government Ginnery by the use of a saw gin. It is contemplated, however, to instal a roller gin for dealing with the next crop, which it is believed will produce a much better grade of cotton.

It is worth while noting that up to the present a large proportion of the cotton exported from the Turks Islands has been harvested from plants with stems in many instances 3 to 4 inches in diameter, which are supposed to be from ten to fifteen years old. It would thus appear that the struggle for existence which this type of cotton plant has waged for over a century with the cactus scrub, has resulted in a type which is able to thrive and to produce heavily under conditions which would seem unbelievable in other cotton-growing islands of the West Indies.

Mr. G. Whitfield Smith, the Commissioner of this group, is to be congratulated on the success which has attended his efforts, and on the possibilities which appear open to this group of islands in the matter of cotton growing.

MANURIAL EXPERIMENTS WITH SEA ISLAND COTTON.

The manurial experiments with Sea Island cotton, which had been carried on for eight previous years in St. Vincent, were continued during the season 1918-19. The general aim of the work has been to obtain reliable information as to the effect of different manures on yield.

The main conclusions arrived at are summarized in the Report on the Agricultural Department, St. Vincent, 1918-19. They are as follows :—

(1) All the manure plots gave greater yields than the unmanured. The largest increase was shown by the plots which received cotton-seed meal, potash, and phosphate. These plots gave 77 per cent. more seed cotton than the unmanured controls.

(2) The next largest increase was shown by the potash plots which produced 62 per cent. more seed cotton than the no-manure plots. Almost as great an increase (56 per cent.) was shown by the plots which received a complete artificial manure.

(3) The conclusion formerly arrived at, that potassium was the element most necessary under the soil conditions of St. Vincent, was thus strikingly confirmed. As in the previous season, the disease known as 'rust' appeared in every plot of the manurial series, but the plots which received no potash were the most severely attacked.

(4) The conclusion that an application of potash alone is more beneficial than a combination of phosphate and potash is again confirmed. The increase in yield of the plots receiving potash alone over those receiving potash and phosphate was 36 per cent. No explanation of this fact can be advanced, but as this increase has been observed for three seasons in succession, planters in St. Vincent can be definitely advised not to apply phosphate to cotton fields.

(5) Poor results were obtained from the manurial use of cotton-seed meal alone, but if used in conjunction with potash, satisfactory results will be obtained.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. LUCIA. Plant distribution during the month of December comprised: limes, 600; Robusta coffee, 250; ornamental plants, 6 ; sugar-cane cuttings, 100 ; miscellaneous seeds, 6 packets. In the Experiment Stations and Botanic Garden, operations were of a general routine character. Regarding staple crops, the Agricultural Superintendent, Mr. A. J. Brooks, states that the cacao crop is nearly over, the lime crop is slackening, and the reaping of the sugar crop was general. The rainfall registered at the Botanic Gardens, Castries, during the month totalled 5·37 inches ; at the Agricultural and Botanic Station, Choiseul, the precipitation measured 2·81 inches.

NEVIS. During the month of December 4,000 sweet potato cuttings and 1 lb. of Para peas were distributed from the Botanic Station. In his observations relating to staple crops, Mr. W. I. Howell, Agricultural Instructor, states that the sugar-cane crop throughout the island is looking very much better, and in some places a good return is expected. Preparation and planting for next crop are in progress, and it is likely that there will be a fair increase in the acreage under cultivation. Picking of the second crop of cotton is in progress, but the returns are poor ; in some places practically no crop will be reaped, as cotton stainers are very plentiful, and a very high percentage of the cotton reaped is stained. Leaf-blister mite is also very prevalent. The crop of sweet potatoes is doing well, and fair returns are expected. The rainfall for the month was 2·89 inches, for the year (1919) 38·22 inches.

AGRICULTURE IN BARBADOS.

January has been a favourable month in apparently every part of the island, except in St. Philip's parish and in the valley of St. George. In both these areas up to the 15th instant it was very dry, and showers were much needed. On the 14th, however, distinctly showery weather began, bringing the total rainfall to date to nearly $3\frac{1}{2}$ inches in Christ Church, and an average of about $2\frac{1}{4}$ inches in the centre and hilly districts of the island.

The weather for the current month is another proof, if any were needed, that frequent showers, particularly at this season, are much more beneficial than a downpour followed by sultry and rainless days.

In spite of the dry weather in St. Philip's parish previously referred to, the spring of young canes in this parish is exceptionally good, and the blades are showing up well above the banks.

As usual, the manuring of the young crop is very far from completion in the red soil, and even in the black soil pens have only recently been pitched in some fields, and these, in all probability, will not be ready for distribution before the end of next month.

With the exception of the fields on the seaboard in St. Philip's parish, the old crop retains its vigour and greenness. In this district the tops have browned rapidly with the high winds and lack of rain during the first half of this month. The present condition of the old crop does not, therefore, point to anything like a start of the reaping season until about the middle or the end of next month on black soil estates, and the middle of March on red soil estates.

Potatoes, while not plentiful, are still being sold at $1·56 per 100 lb., and yams may now be purchased at $1·80 per 100 lb. At this date last year this vegetable was being sold at $1·00 per 100 lb. Fields of these are being rapidly sold by the hole. The yam crop in the red soil districts has been, it is stated, a general failure. The eddo crop has been greatly improved by the recent showers, and the fields of white eddoes present a very promising appearance. (The Barbados *Agricultural Reporter*, January 24, 1920.)

SISAL HEMP IN JAMAICA.

According to the Report on the Department of Agriculture, Jamaica, for the year ended March 31, 1919, it appears that the cultivation of sisal for the production of fibre is commanding a good deal of attention in the island. It is recognized as a valuable industry, which is specially suited for limestone areas in Jamaica, where other exportable products cannot profitably be grown.

The Government have established a plantation at Lititz where there was at the end of March 1919 a total of about 500 acres planted in sisal. There were 5 acres each of sisal and henequen planted in 1914 on a piece of the worst land at Lititz The leaves from these plots were tested in the year reported on for amount of yield and quality of fibre. The sisal gave larger and heavier leaves, and a higher percentage of fibre than the henequen. The fibre from Lititz was reported on by a trade expert in New York as of 'unusually good type,' and was valued at £75 per ton. The yield of fibre with plants set out 6 feet by 5 feet at Lititz would appear to be about $\frac{3}{4}$ ton per acre for the first crop. The cost of bringing an acre of sisal to the reaping stage was about £3. The financial aspect of the enterprise is therefore most encouraging. It should be noted that the land at Lititz has been so useless hitherto that no one had ever been willing to pay taxes on it, or to own it.

The first crop will be ready to reap in 1920, by which time it is hoped that a factory containing the necessary machines for extracting the fibre will be erected.

An important point was brought out during the year. Two lots of sisal fibre from Jamaica sold for the same price in the United States market. One shipper, however, netted £10 per ton more for his fibre than the other, because it had been well compressed in a cotton baler, and therefore he saved this amount in the cost of delivery to the market. It would therefore appear desirable to install high-power hydraulic balers in sisal factories, so as to secure economical transport.

Sisal can be grown with success on any soil derived from limestone in Jamaica. The clays and alluvial gravels derived from non calcareous volcanic rocks should be avoided, as on these soils the sisal plant poles prematurely, thus leading to failure from a financial point of view. This conclusion should be borne in mind, and observations made on similar lines in other places.

Landowners who take up the sisal industry should recognize that 200 acres is the minimum for a self-contained project. The ideal plantation should provide for a first start of 200 acres, and 100 more acres yearly, until 700 acres have been planted, when the original 200 acres should be replanted.

The requirements for water are not very great, as the decortication requires none, and only a supply for the engine is necessary. The sisal industry in Jamaica is affording congenial and remunerative employment for men, boys, and women.

Owing to the considerable demand for rope in the colony, it is hoped to establish a rope factory shortly for the utilization of locally produced fibre.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

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†*Provided by the Imperial Department of Scientific and Industrial Research.*

Agricultural News

VOL. XIX SATURDAY, FEBRUARY 7, 1920. No. 463.

NOTES AND COMMENTS.

Contents of Present Issue.

The editorial draws attention to the serious condition in regard to the inadequate stock of food-supplies at present existing throughout the world.

An important article under Insect Notes on page 42, treats of the dependence of bug injury on plant condition.

On page 35 will be found an interesting account of fifteen years work of the Antigua Sugar Factory, which is supplemented by the Annual Report, which is noted on page 45.

Notes on Dominica.

A revised and enlarged edition of the pamphlet entitled, 'Notes on Dominica and Hints to Intending Settlers', prepared originally in 1903 by Sir Henry Hesketh Bell, K.C.M.G., when Administrator of that island, has recently been issued. This edition has been prepared by Dr. H. A. Alford Nichols, C.M.G., and contains information quite up to date. It contains many interesting illustrations of the scenery, and of points relating to the chief industries of the island, namely, limes and cacao.

The latter portion of the pamphlet consists of a useful list of valuable timbers of Dominica, giving both their local and scientific designations. Should a further edition of the pamphlet be called for, it is to be hoped that many printer's errors which appear, especially in the botanic names of the trees, will be corrected.

Our Soldiers' Graves.

Considering that there is hardly a family in the British Empire from which one or more members have not given their lives for their King and Country, and whose bodies now lie 'somewhere in Flanders' or elsewhere on the almost world-wide battle front, a paper read at a meeting of the Royal Horticultural Society in February last year by Capt. A. W. Hill, Sc.D., Assistant Director of the Royal Botanic Gardens, Kew, on the subject of the care of our soldiers' grave is of general interest. The *Journal of the Royal Horticultural Society* published the paper referred to in its issue of October 1919.

Captain Hill, who is Botanical Adviser to the Imperial War Graves Commission, points out that it must never be forgotten that our nation owes to the unexampled generosity of the French, the possession in perpetuity of the plots of ground where British Cemeteries have been established. The French passed a law at the close of 1915 by which, having assumed the necessary power, they undertook to purchase all such plots, and present the 'right of enjoyment' of them as a free gift in perpetuity to the British Nation, the British Government on its part making itself responsible for their maintenance. Similar concessions have been generously granted by the Belgian and Italian Governments.

The whole question of the care of soldiers' graves came before the recent Imperial War Conference. As a result of the deliberations of that body, the Imperial War Graves Commission was constituted by Royal Charter, and now forms the permanent body to whose care the maintenance of our Military Cemeteries in France, Belgium, Italy, and elsewhere will be entrusted.

A Horticultural Department, carefully organized, working in conjunction with a body of skilled and well-known architects, is proceeding with the planning and planting up of the Cemeteries in an orderly and regular manner. Although during the war the funds for this gardening work were supplied by the British

Red Cross Society and the Order of St. John of Jerusalem, for the permanent planting and upkeep the recently established Imperial Commission will make itself responsible.

The Commission is attempting to plant, in Cemeteries where men from the Overseas Dominions lie buried, trees or other plants characteristic of the countries whence they came to the defence of the Empire. To mark, however, with characteristic plants the graves of the representatives of many portions of the Empire is impossible in a northern climate.

Not all who perished on the battle field lie in identified graves, for 'some there be who have no memorial: who are perished as though they had never been.'

But for them all the grateful memory of their sacrifice in the great cause will ever remain enshrined in British hearts.

The endeavour of the Imperial War Graves Commission is to make those sacred plots—those fields in Flanders that are 'for ever England'—worthy memorials to those who gave their lives in the cause of liberty, and for the safety of our Empire.

Hybrid Bougainvillaeas.

In the Report on the Agricultural Department, St. Vincent, for the year ended March 31, 1919, Mr. Sands, then Agricultural Superintendent of that island, notes that the receipt of some seeds of Bougaivillaea hybrids from Dr. Perez of Teneriffe, and the flowering of two of the plants raised from the seed so obtained, led to a good deal of attention being devoted to the question of obtaining seed from the different varieties cultivated in the Botanic Gardens, St. Vincent. These were: the three varieties with magenta bracts, namely, *Bougainvillaea glabra*, *B. sanderiana*, and *B. spectabilis*; the one with terra-cotta bracts, *B. laterita*; and the crimson variety commonly known as 'Mrs. Butt.'

Repeated attempts were made to self-fertilize the flowers, but unsuccessfully. On the other hand, the different varieties were found to cross readily with each other, although not a single seed of a natural cross had ever been found previously on the plants.

It takes about thirty days from the pollination of the flowers to the ripening of the seed and the seeds, which resemble grains of wheat, take ten days to germinate in partially sterilized soil.

Seedlings have been found rather difficult to raise; they are often lost through imperfect germination.

The two F^1 plants, raised from the seed obtained from Dr. G. V. Perez of the cross between *B. laterita* and *B. glabra*, have borne flowers with magenta bracts and glabrous leaves. The crosses made in St. Vincent between *B. laterita* and the crimson variety 'Mrs. Butt,' as well as those between *B. laterita* and *B. sanderiana* have given indications of segregation at an early stage. The flowering of these is awaited with interest.

It seems probable that the magenta colour in the bracts is dominant over the crimson and terra-cotta red, as all hybrids raised in the West Indies, so far as is known, in which a magenta-bracted species was one of the parents, have produced magenta-coloured bracts.

Research Institute for New Zealand.

An article in *Nature*, January 1, 1920, draws attention to the foundation of a Research Institute for the Dominion of New Zealand. It appears that the late Mr. Thomas Cawthorn, of Nelson, New Zealand, left the sum of £240,000 for founding a Technical Institute. The trustees were unanimous in desiring that the Cawthorn Institute should be a Research Institution, and appointed a private commission of scientific men to advise as to the best method of procedure. The main recommendations of the commission have been adopted by the trustees. The chief work of the Institute is to be 'instruction in and performance of scientific research; such research to be definitely related to the industries of Nelson and the Dominion.'

A beautiful site has been secured for the necessary buildings, which will be commenced at an early date. The Director has been appointed and also the Agricultural Chemist, and other staff appointments will shortly be made.

A liberal scheme of scholarships and fellowships is arranged, so that University graduates may be attracted to carry out investigations under the guidance of members of the staff.

Though it is intended that the work of the Institute is to have a distinct economic bearing, it has been made clear that the trustees recognize that no sharp line can be drawn between technical and scientific research, and that the term 'technical' will be understood in a broad and liberal sense.

Rice Cultivation in St. Lucia.

For many years past the East Indian labourers in the sugar estates situated in the flat and somewhat swampy lands in the valleys of St. Lucia have grown swamp rice for their own consumption.

The Report on the Agricultural Department of that island for the year ended March 31, 1919, draws attention to the fact that owing to the shortage of imported cereals due to war conditions, the cultivation of rice had received during the three years previous attention from some planters. A considerable extension therefore of the area under rice has taken place.

Seeing that something like £3,000 worth of this cereal is imported into the island annually, there is a good local market for the product. It is satisfactory to learn that the estimated production for last year was about 250 tons of paddy. It was, however, supposed that at least 150 tons more of rice would be required for the needs of the population. As there is not sufficient swamp land in the colony to raise the whole of this extra quantity, attempts are being made to extend the cultivation of upland or hill rice.

INSECT NOTES.

DEPENDENCE OF BUG INJURY ON PLANT CONDITION.

The following extracts from a report by P. H. Carpenter and E. A. Andrews are reprinted in the *Tropical Agriculturist*, November 1919, from the *Planter's Chronicle*, Vol. XIV, No. 38. The report deals with the so-called mosquito blight of tea, and is of interest in its bearing on the question of the influence of the condition of the host plant on infestation with sucking insects. This question has been much discussed in relation to thrips attack on cacao in Grenada, and more recently to froghopper blight on sugar-cane in Trinidad. Belief in the reality of the relation is the reason for the advice given in regard to these pests, namely, to increase the resistance of the plant by improving agricultural conditions; and it is interesting to have this supporting evidence relating to a similar pest of another crop.

The mosquito blight, it may be mentioned, has no connexion with mosquitoes; it is caused by a Capsid bug of the genus Helopeltis.

THE INSECT AND THE BUSH. In all cases of serious illness a doctor endeavours to increase the vitality of the patient by attention to diet. It is the same with insects. Given an abundant and suitable food-supply, they multiply rapidly, are capable of doing greater damage, and show greater resistance to climatic variations, insecticidal treatments, and so on. In the absence of a suitable food supply they are unable to flourish, even when other conditions are favourable. Observations showed that, of neighbouring sections on a garden, one would suffer severe damage while another was left practically alone. They showed, moreover, that on one section neighbouring bushes would show different degrees of resistance to attack. This appeared to indicate that some bushes were more suitable as food than others. Experiments with the insects in captivity have shown that their degree of vitality can be varied at will by feeding them on shoots from bushes, plucked from the same section, which show different degrees of resistance to attack. Leaf plucked from bushes which were badly attacked was severely damaged, the punctures made were extensive in area, and the insects remained lively. When these insects were given leaf from neighbouring bushes free from attack, the punctures made were small, at first fairly numerous, as the insect kept searching for food, later less numerous, as the insect lost vitality, and the damage done to the leaves was slight, and the insects became listless, and finally died By replacing this leaf with that from badly blighted bushes before the insects died, they could be brought round again; large punctures were again made in the leaves, and the damage done to the shoot was considerable. This shows how the insect could be kept under, if the bushes could be brought into the proper condition. The condition of a bush is dependent on its environment. Given a suitable environment, the necessary condition for resistance can be brought about, as we know from field observations. The environment of a bush is mainly a combination of two factors, soil conditions and climate.

SOIL CONDITIONS. By the end of 1913, it had been observed that the distribution of mosquito blight appeared to be connected with soil conditions, and investigation was commenced in this direction. This necessitated the collection of soil analytical data, and the study of these revealed that, although the soils under consideration were of entirely different types, there were certain similarities in regard to chemical composition of the soils on which mosquito blight was prevalent. These similarities were found to be connected with the available potash-phosphoric acid ration

WATER-LOGGING. Experiments were carried out which showed that the addition of potash to a soil had an appreciable effect in reducing mosquito, but that its action was irregular. Analyses of leaf, carried on at the same time, also showed that this ratio appeared to be connected with mosquito attack. There were, however, apparent exceptions to this theory, and this led to a further study of general soil conditions. Touring in districts (Assam) where mosquito blight was not generally prevalent, but where small areas were affected in certain years, brought out the fact that these areas were subject to water-logging. The recent tours of the Acting Chief Scientific Officer in the Dooars and Terai convinced him of the correctness of these observations. Water-logging was a general characteristic of the district, and excessive water-logging of the worst mosquito affected patches. A commonly occurring plant amongst the tea was *Cyperus Iria*: this is a sedge and not a grass. Sedges can only grow in excessively damp situations.

The data collected in regard to this were so numerous, and the phenomenon was so wide-spread, that it became evident that, whatever be the factors influencing the liability of the bushes to mosquito attack, water-logging is one which demands immediate attention. Furthermore, it was noticed that, in places where mosquito blight was less in evidence, the soil was not water-logged to the same extent, aud a certain number of instances were observed in which the soil was obviously well drained, where freedom from mosquito was an accompaniment.

Water-logging has the effect of generally lowering the vitality of the tea bush. This is shown in the yellow leaf, spindly framework, slow growth, diseased wood, exceptionally weak sides, by the fact that the bushes do not fill up, in general debility. This in itself, is sufficient evidence that bushes in a water-logged soil are unhealthy, and, when we observe that bushes in water-logged conditions are more liable to mosquito blight, it becomes obvious that the first necessity is to improve the health of the bush, and the first thing to be done is to provide means whereby excessive accumulation of water in the soil is avoided. Unless this be done, no other treatment can be expected to give adequate results. This accounts for the unsatisfactory results obtained in many field experiments carried out on gardens. It is necessary here to explain what is meant by health. Health is not relative but absolute. The best bush in any one district, may not necessarily be a healthy bush. It may be in one district that environmental conditions are much less suitable than in another. Under such circumstances, it is conceivable, taking an extreme case, that the best bush in the former district might be less healthy than the worst bush in the latter. This being so, it is impossible to take any standard afforded by knowledge of one district alone. We know poor tea which never suffers from mosquito, although climatic conditions are suitable for the development of the insect, while apparently better tea is attacked. In the one case we have a more healthy bush suffering from lack of nourishment, whereas in the other case, we have an unhealthy bush deriving advantages from a plentiful but ill-balanced food-supply. Our experience leads us to the conclusion that the unbalanced state of soil conditions conducive to mosquito blight attack is controlled very largely by the water content of the soil. The importance of water-logging has been

emphasized. There are also certain other soil conditions which have been found to upset the balance, with similar results. These are soil acidity, and soil denudation, either one of which, under certain conditions, may be a more dominant factor than water-logging in particular instances. We can now deal more particularly with these conditions.

In the absence of cultivation, a large proportion of the rainfall runs over the surface of the soil, and does not penetrate, whilst, when the surface of the soil is opened up by cultivation, such as hoeing, etc., much of the water which previously ran away sinks in. It is, therefore, far more necessary on cultivated soil to provide means for removing excess water by drainage. The extent to which this is necessary will vary according to the nature of the agricultural practices carried out. Practices which may tend to increase water content of a soil are the construction of contour bunds, blind contour drains, and trenching across the slope of the land. These practices result in the retention of water on the land, with the consequence that the whole of the rainfall for that area has to penetrate through the soil. The object of contour bunding and contour drains is to prevent erosion of the soil by surface wash, and for this purpose they are well suited; but some provision must be made for the rapid removal of the water which accumulates in the drains, and therefore, blind drains are unsuitable in a soil subject to heavy rainfall, which is of such a mechanical texture that movement of water through the soil is slow, such as happens in the case of clay and fine silt soils.

SOIL ACIDITY. Another factor found to run parallel with mosquito blight, and which largely influences the health of the bush, is soil acidity. Acidity in a soil is of course one of the results of water-logging, but the importance of this factor arises from the fact that the alleviation of water-logged conditions will not necessarily remove the acidity of the soil, so that in any scheme for increasing the vitality of the bushes, means of correcting acidity of the soil must be included. Acidity in a soil inhibits desirable bacterial development, such as that of the nitrifying organisms, whilst it tends on the other hand, to increase the activity of other organisms, such as denitrifying bacteria. It also encourages the growth of protozoal organisms, many of which feed on the beneficial bacteria.

SOIL EROSION. Another feature shown by the results of the investigations is that, in some cases the incidence of mosquito blight does not appear to be connected with water-logging and acidity, but is definitely connected with poverty of the soil due either to exhaustion or soil erosion. This is a controlling factor in fewer instances than the before mentioned factors, but it may be of sufficient importance to demand attention. The circumstances affecting this factor are different from those affecting the above mentioned factors, in that, here, while there may be no preference shown by the insect for these bushes, yet the power of resistance of the bushes to any form of disease is so slight that they rapidly succumb to attacks. In districts where mosquito blight is prevalent, such bushes are attacked readily. This factor has only been found to be operative in districts where climatic conditions are known to be exceptionally favourable to the development of the insect.

CLIMATIC CONDITIONS. In all circumstances, the primary controlling factor is the nature of the climate. We can distinguish between districts in which the climate is entirely suitable to the development of the pest and others which it is less suitable. Climate, however, being a factor which is entirely beyond our control, it is obvious that some gardens will always be assisted in their fight against the pest by climatic conditions, while others will always be hampered.

TROPICAL HEALTH CONDITIONS.

In the discussion which followed the reading of a paper by Sir Edward Davson on the problems of the West Indies, at a meeting of the Colonial Section of the Royal Society of Arts, December 9, 1919, Dr. Lewis W. Sambon, who visited the West Indies on behalf of the Colonial Office in 1913 for the purpose of studying pellagra, took the opportunity of making some remarks on the health conditions of the West Indies. He said that he did not wish to convey a wrong impression. Although several grave diseases were prevalent, the islands were not less healthy than some of the rural districts at home. However, sanitation had been sadly neglected, and disease was rampant in many of the islands. The physicians there were zealous and well-informed, but they suffered from lack of laboratory equipment, means, support, and authority.

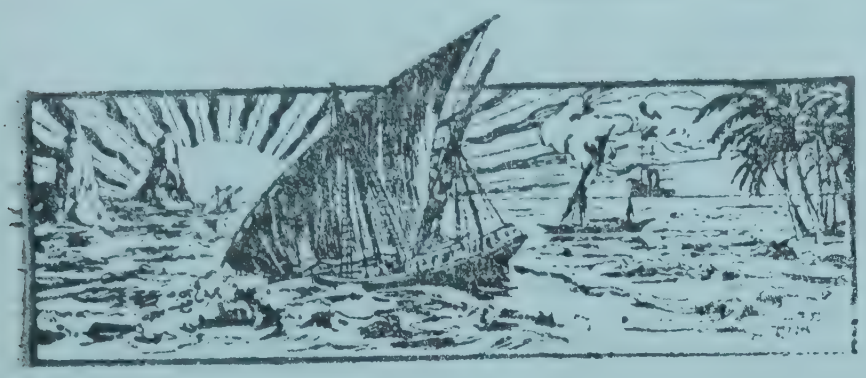
Pellagra was a disease that had been recently discovered in the West Indies, and had caused some alarm, especially in Jamaica and Barbados, simply because it had not been recognized before. That disease, which was very widely spread throughout the world, had been found by him in every one of the islands of the West Indies, although possibly in some of them it might not be locally contracted. He had studied especially Barbados, Antigua, and Jamaica, and there he believed he had been able to locate the exact sites where the disease was endemic.

In the West Indies most tropical diseases were represented, because those islands for centuries had received a constant stream of African and, more recently, Hindu and Chinese labourers, and because they probably represented the remnant of a land, now submerged, which at one time united Africa, Brazil, India, and even Australia, which then formed one great continent.

That was very long ago, perhaps before the tertiary period, but diseases were also very ancient. When people spoke of new diseases they generally meant diseases that had not been previously recognized. The very same parasites that now existed in Egypt could be actually found by making sections of mummies of people who lived there five thousand to seven thousand years ago, and parasites that now attacked mammals and birds could be traced in the present representatives of animals that lived long before mammals and birds came into existence. Those interesting facts might, perhaps, one day lead people into a new field of research, namely that of the tracing of diseases back along the paths of their migration to their cradle lands.

Thus, for instance, yellow fever was found on the west coast of Africa, and also on the east coast of America; and why was it found on both sides of the Atlantic? It had probably been there from time immemorial, long before the discovery of the New World by Columbus, and had possibly been there from the time when the two continents were connected.

In the Panama Canal Zone yellow fever was got rid of in about eighteen months, and malaria was also reduced to almost complete disappearance. What had been done there could be done far more easily in the Lesser Antilles. Many years ago he suggested that the white man could live perfectly well in a tropical country. It was not the heat or other climatic conditions, but the parasitism of the tropics that had brought about the wilting of the white race in those regions. Surgeon General Gorgas had said that over 10,000 white men with their wives and children, had lived in Panama for over ten years, continually exposed to rain and heat and every possible condition of a tropical climate, in perfect health; and what had been done there could be accomplished anywhere else.



GLEANINGS

According to *Revista de Agricultura de Puerto Rico*, November 1919, the floury substance contained in the large bean of the locust tree (*Hymenaea Courbaril*) when mixed with luke-warm water soon begins to ferment, and after a certain period provides a fairly agreeable beverage; it is said, to taste not unlike beer.

Dealing with the question of fuel in sugar-cane factories, a recent writer says that in furnaces where oil is used a higher temperature has to be attained to accelerate combustion, and that the firebrick must be of such a quality that the fusing point will be at least 3,300°F. (The *South African Sugar Journal*, November 1919.)

A note in the *India Rubber Journal*, December 13, 1919, states that it is reported that a company, has been formed in Japan, with a very large capital, for the manufacture of a celluloid substitute, based on the utilization of albumen obtained from soya beans, which are available in large quantities at a very low price. The product is stated to be adapted for the same uses as celluloid.

With the opening of another dyewood factory in Jamaica, making three in all, the price of logwood is increasing, owing to competition to secure the wood. It is expected that within the next three months logwood will realize £10 per ton in the local market. Plans for a fourth dye factory are nearing completion, and it is possible that before long a scheme for a fifth factory will be launched. (*The Times* Trade Supplement, December 20, 1919.)

A curious theory, which is said to be an old one, is mentioned in the *Farm Journal* for January 1920 The theory is this: eggs with the air bladder in the centre of the crown of the egg will produce cockerels; those with the bladder on one side will produce pullets. The position of the bladder can easily be made out by holding the fresh egg up to a strong light. The accuracy of the theory is not vouched for, but it might be of interest for poultry keepers to test its truth.

In the *Weekly Bulletin*, Department of Trade and Commerce, Canada, November 24, 1919, it is stated that Bermuda is entirely dependent on outside supplies of foodstuffs, except vegetables. Consequently the cost of living became very high in 1918. The tourist trade, which contributes no little to the resources of the island, had almost disappeared. In 1913 upwards of 20,000 tourists visited the island, whereas in 1919 the number was only 1,330

The mulching paper manufactured in Hawaii on Olaa plantation is reported to be in demand by other plantations. Experiments conducted by one of the sugar companies to determine the value of the paper mulch as a factor in reducing cultivation costs have given encouraging results. The cost was reduced one-third, while the production was increased by ½ ton of sugar to the acre. (*Facts About Sugar*, November 29, 1919.)

The *Morning Post*, December 23, 1919, draws attention to a meeting of the sugar planters of Jamaica in the week before Christmas to discuss local sugar prices. The meeting determined that, no matter what the selling price of sugar was abroad, the Jamaica consumer must not pay more for his sugar in 1920 than he has paid in 1919. The retail price of sugar was fixed at 4½*d.* per lb., and an adequate percentage of the island's sugar is to be retained for local consumption.

It is of great importance that all tins supposed to be hermetically sealed should be tested for leakage before being put into store. With regard to the occurrence of live insects in tins supposed to be hermetically sealed, it is certain that in really air-tight tins no insect can remain alive when once the supply of oxygen originally present has been used up, and it is very unlikely that any serious damage can happen to the contents of the tin in the meantime (*Physiological Abstracts*, December 1919.)

It is announced that the Shipping Board of the United States has definitely abandoned the coal-burning ship, and has ordered that 636 vessels under construction for the Emergency Fleet Corporation shall be oil consuming. A recent test of two ships of equal tonnage between New York and Santos, Brazil, showed that the oil-burners had an advantage of three days in time, and 298 tons in fuel, while the removal of the coal bunkers added 25 per cent. to the cubic cargo capacity, and reduced the crew by about 12 per cent. (*Daily Express*, December 30, 1919.)

The Argentine ant (*Iridomyrmex humilis*) was introduced twenty-seven years ago into Madeira. It has become a serions pest ; coffee cultivation has been ruined, and every sort of fruit tree—citrus especially—has been almost entirely destroyed. Sugar-cane and banana still exist, though badly attacked, but sweet potatoes have disappeared in many districts. It was suggested by Dr. M. C Grabham, at the recent meeting of the British Association, that British colonies should be warned as to the importance of this pest, (*Nature*, January 1, 1920.)

The Department of Agriculture, Federated Malay States, has recently issued an important *Bulletin*, No. 30, on food production in Malaya. One of the items of interest is on the preparation of sweet potato biscuits. The following is the recipe for making them : The fresh tubers are cut into thin, transverse slices; these slices are then fried in lard, and are afterwards dipped in melted sugar. After drying, the biscuits will keep as well as any other biscuits if stored in air-tight tins. It is said that sweet potato biscuits are equal, if not superior, to ordinary European sweet biscuits.

SUGAR INDUSTRY.

REPORT ON THE ANTIGUA SUGAR FACTORY.

The fifteenth annual report of the Directors of the Antigua Sugar Factory, Limited, for the year ended September 13, 1919, has recently been published, from which the following facts are gathered.

The company has had a satisfactory year. The rainfall averaged about 36 inches, which is below the normal, and consequently the supply of canes was somewhat deficient, but canes were received from some outside estates which increased the total supplies.

In response to the Board of Directors' appeal in the previous year for more regular deliveries of canes, many of the contracting estates gave special inducements to their labourers to work on Mondays, and the result has been very satisfactory. There was a marked improvement in deliveries, the hours during which the factory was out of canes being only 2 per cent. of the total working hours.

The following figures give the result of the year's work, and a comparison with previous years :—

		1905-7	1908-10	1911-13	1914-16	1917-19	1919
		3 years.	3 years.	3 years.	3 years.	3 years.	1 year.
		Average.	Average.	Average.	Average.	Average.	
Canes	Tons	27,106	42,888	61,612	92,302	85,690	90,186
Sugar	,,	2,737	4,693	6,349	9,970	9,586	9,739
Sucrose in cane	Per cent.	14·17	14·37	13·74	12·67	12·79	12 30
Sucrose in megass	,,	7·33	6·07	4·61	3 22	2·63	2·77
Purity of juice		87·60	85·38	83·70	83·90	83·83	83·06
Recovery of sucrose per 100 of sucrose in cane		68·43	73·10	72·18	82·06	84·15	84·36
Yield of sugar per 100 of cane		10·03	10·93	10 32	10 78	11·20	10·80
Price of sugar per ton, f.o.b.		£10 5 4	£11 13 3	£11 1 9	£14 7 8	£21 8 6	£24 14 1

Canes were supplied to the factory as usual on a profit-sharing basis. To original contractors, who suppled 22,495 tons of cane, a first payment of 23*s.* 3*d.* per ton was made, and they also received an additional payment of 18*s.* 5*d.*, making a total of 41*s.* 8*d.* per ton of cane.

To new contractors, who supplied 64,957 tons of cane, a first payment of 25*s.* 3*d.* per ton was made, and an additional 7*s.* 6½*d.*, making 33*s.* 5*d.* per ton of cane.

It is to be remarked that these prices were paid for canes delivered into the Company's railway trucks, the expense of transport from the point of delivery to the factory being borne by the Company.

With regard to expenditure, the following items are interesting: factory charges, under which were included, cost of manufacture, salaries, repairs and maintenance, etc., amounted to £4 10*s.* 6½*d.* per ton of sugar made; for railway transport of cane, sugar, etc., the cost amounted to 16*s.* 1*d.* per ton of sugar; administration charges, including directors' fees, came to 4*s.* 9½*d.* per ton of sugar.

An important point is that, the debentures being now practically all redeemed, the debenture interest was only £195, while general interest and exchange amounted to £4,556.

The total revenue of the factory was £252,463 for the year, while the expenditure was £186,459, thus leaving a surplus profit for division between the cane growers and the shareholders of £66,003, of which £45,258 were paid to growers as bonus on canes supplied, the remaining £20,745 being the shareholders' proportion of profit. This added to previous reserves, made a total of £40,616 to the credit of the shareholders.

The Directors recommended that a dividend of 10*s.* per share, less income tax, be paid, absorbing £6,250, and leaving a balance of £34,366.

THE AVOCADO IN TRINIDAD AND TOBAGO.

The interesting paper contributed by Mr. W. G. Freeman, Director of Agriculture, Trinidad, to the *Bulletin of the Department of Agriculture* of that colony, Vol. XVIII, Part 3, was referred to in the previous issue of the *Agricultural News*, and the extraordinarily less oil content of the fruit grown in Trinidad, as compared with those grown in California, was noticed. Mr. Freeman's paper is so full of instructive matter that many other points are worth attention.

Mr. Freeman doubts that the tree is properly indigenous to the West Indian islands, but believes it to have been introduced into them at an early date from its original habitat, Mexico or Peru. He quotes the earliest references to the avocado as growing in the West Indies, (1) from Sir Hans Sloane's History of Jamaica, published in the first quarter of the eighteenth century, (2) from Dr. Patrick Brown's Civil and Natural History of Jamaica, published in 1756.

To Mr. Freeman's notices may be added (3) a mention of the fruit which may be found in Hughes's Natural History of Barbados, published in 1750.

In all the old accounts it will be found that there was a considerable variation in the spelling of the name of the plant, ranging from avocado—which is the name now advised to be authoritatively used—to 'alligator pear.'

From its original home, the avocado has been introduced not only into the West Indies but into many other tropical and sub-tropical countries. The tree grows and fruits well in Southern India, Ceylon, and parts of the Federated Malay States. In Tropical Australia the avocado thrives. In Africa it has been known for some time in Natal and in the Congo, and recently requests have been made to the Trinidad Department of Agriculture from Egypt for large quantities of seed. In Hawaii great attention is paid to the cultivation of the avocado; but it is in Florida and Southern California that the greatest interest is being displayed in avocado cultivation, evidence of which is afforded by the existence of the California Avocado Association, from the proceedings of which, at a meeting in October 1916, it appears that no less than 140 named varieties were under cultivation and trial in California alone.

Although so long cultivated in the West Indies, little attention appears to have been given until quite recently to the selection, introduction, and propagation of good varieties of avocados.

As with most other fruits, propagation by seed is an unreliable means of securing good kinds. In many cases no effort at selection was made even in selecting seeds of good specimens of fruit, but any seeds were sown of good, indifferent, or bad kinds. Even with seed selection the results are not to be depended upon, as it may occur that an undesirable large-seeded and thin-fleshed fruit may be produced by a seedling of a tree bearing large fruits with small seed and thick flesh. By budding or grafting, however, the particular variety which it is desired to produce is ensured.

The result of the indiscriminate planting of seeds has been that, of the enormous numbers of trees to be found in Trinidad, Barbados, and throughout the West Indies, some produce very good fruit, many of a medium quality, but a very large number are of a poor type.

Mr. Freeman goes on to describe the process by which two types of avocado have been selected by the Department of Agriculture of Trinidad as worthy of propagation by budding and distribution. It must also be remembered that trees producing poor fruit can be cut back, and desirable sorts budded on new shoots from the cut trunk.

With regard to the question of growing avocados for export, it is noted that in November 1913, Professor Carmody took with him to England two cases of this fruit. They were kept in the vegetable room of the ship at a temperature of 45°F., and arrived in splendid condition. They were sold at the Army and Navy stores, 3 dozen of them at 12*s.* per dozen, and 2 dozen at 10*s.* per dozen. As however the colony does not yet produce enough avocados for its own requirements, it is perhaps premature to think of an export trade. The important thing is to grow more of the good kinds

Following Mr. Freeman's paper in the same Bulletin, there is an article on budding the avocado, by Mr. R. O. Williams, then Curator, Botanic Gardens, Trinidad, now Superintendent of Agriculture, Grenada.

Until recently the budding of the avocado was thought to be a very difficult operation, but in 1903 it was reported from the Jamaica Agricultural Department that the method employed in budding citrus had proved successful in budding avocados, with scarcely the loss of a single bud. Similar success was recorded by Mr. J. Jones at the Dominica Botanic Station in 1912.

Mr. Williams states that the best method of budding is that generally adopted for roses and citrus, namely the T method. The patch method is also sometimes used in the case of thick stocks.

Branches from which buds are to be taken must be chosen from matured wood about twelve months old. It is preferable to select buds from which the leaves have fallen, or to cut off the leaves, leaving a few inches of the petioles attached, a few weeks before the buds are wanted. The bud should then be taken off with about $\frac{1}{2}$ to $\frac{3}{4}$ inch of bark, and inserted in the usual way.

With regard to the stock on which the buds are to be inserted, it is very important for success that the stock be young. The proper age at which to expect the best results is when the seedlings are from six weeks to five months old. The method of top working old trees, by cutting them back and allowing new shoots to grow, agrees with this in principle, as the buds are inserted on the young shoots springing from the pollarded branches. It is found that the seed required for stock purposes may be sown and successfully grown in bamboo pots.

Another important factor for success is the season in which to bud. It is found in Trinidad that if the plants are exposed to heavy rains at too early an age, many are lost.

After the bud has made a union with the stock, the latter should be trimmed off 4 or 5 inches above the point of insertion. It must not be trimmed back completely till the bud has made several inches of good strong growth, and formed a complete union with the stock. If the stock is cut back closely before the bud is properly united, it often dies back below the point of insertion of the bud. This is one of the most important facts to remember in connexion with the budding of the avocado. As in the case of other budded and grafted plants, any shoots arising below the inserted bud should be removed as soon as they appear.

BARBADOS: REPORT ON THE SUGAR-CANE EXPERIMENTS FOR THE SEASON 1917-19.

This is the usual joint report, recently issued by Prof. J. P. d'Albuquerque, Island Professor of Chemistry and Agricultural Science, and Mr. J. R. Bovell, Director of Agriculture, on sugar-cane experiments conducted in Barbados during the season 1917-19. This, like previous reports, is divided into three parts : Part I. giving the distribution of the rainfall, Part II. dealing with manurial and other experiments with sugar-cane, and Part III. relating to experiments with varieties of sugar-cane.

As in former years, the experiments were directed to ascertaining the effect of the application of farmyard manure in ordinary quantity, and in double the ordinary quantity ; also the effect of nitrogen, phosphate, and potash upon the industrial yield of the sugar-cane. The results (which are given in tabular form) from a number of the plots are said to be different from those of previous years before the advent of the root borer (*Diaprepes abbreviatus*), and the brown hard back (*Phytalus smithi*). These pests are now doing much injury to the sugar-canes not only in the district where the experiments were carried on, but in other districts of the island. The results are thereby rendered so conflicting that it is impossible to draw any conclusions from them It might here be observed that a similar condition of things appears to have prevailed in the previous season when the same pronouncement was made in regard to the results then obtained.

The monetary loss sustained from the attacks of these pests is said to be considerable ; an instance is given where the estimated loss works out at the rate of 4·36 tons of cane per acre, which at the average price received per ton of canes, represented a minimum monetary loss of $38·98 per acre.

The effort made by the Barbados General Agricultural Society to assist in combating these pests by issuing a pamphlet to each planter containing recommendations for keeping the pests in check, would appear not to have received full co-operation by the planters, for it is mentioned in the report that printed forms sent out to ascertain the extent to which the recommendations were carried out, were, in a number of instances, returned so incomplete that it was impossible to draw any conclusions from them. 'In several instances, the forms were returned with the statement that no root borer or brown hard back existed on the estates reported upon, when it was known that on some of the estates either one or the other or both of these pests were present.' Eighty six of the planters to whom the pamphlet was sent, took no notice of the request for information as to what had been done on their estates.

As to the number of seedlings raised during the period under review, it is mentioned that in 1917, owing to the suitable weather conditions, about 15,000 seedling sugar-canes were grown. Of these 4,977 were potted out, and 2,724 of the more vigorous were planted at Waterford in 1918. These seedlings grew well, and during the reaping season of 1919, 340 were reaped, and the juice analysed. Of these latter 98 were, from their high tonrage and rich juice, considered worthy of retention. Owing to the favourable weather conditions that prevailed during the flowering season of the sugar-canes in 1918, over 15,000 seedlings were obtained. Of those that germinated, 6,069 were potted out, and a first selection of 2,946 of the more vigorous were planted in April 1919, in land rented from Waterford plantation.

Since 1898 a total of 92,675 sugar-canes have been raised from seed and potted out. Of this number 7,401 reached the second stage. Of these latter 3,298 varieties were under cultivation during the season 1917-19, and 767 varietal and manurial plots were reaped, and the juice from the sugar-canes analysed.

As a considerable number of planters are growing three of the newer seedlings favourably reported on in the previous season, viz., B. H. 10 (12), Ba. 6032, and Ba. 7924, the results obtained with these three canes are compared with the White Transparent and B. 6450, each of the newer varieties being grown on the same estate, in the same field, and under the same conditions as the White Transparent and the B. 6450. As is seen from Table XVIII, in which the results are recorded, under the conditions mentioned above, B.H. 10(12) yielded, on the average for six years from forty-eight plots, 10,852 lb. of saccharose or 4,100 lb. per acre more than the White Transparent, and 2,314 lb. per acre more than the B. 6450. Ba. 6032, under similar conditions for five years, from seventy-six plots, yielded 2,987 lb. saccharose per acre more than the White Transparent, and 1,020 lb. per acre more than B.6450. Ba. 7924, under similar conditions, for six years from forty-two plots, yielded 2,517 lb. saccharose per acre more than the White Transparent, and 715 lb. saccharose more than B. 6450. Expressed in percentages, the B.H.10 (12) gave an increased yield, on the average for six years, over the White Transparent of 60·7 per cent., and over the B. 6450 of 27·1 per cent. The Ba. 6032 gave an increased yield, on the average, over the White Transparent for five years of 49·5 per cent., and over the B. 6450 of 12·7 per cent. ; and the Ba. 7924 gave an increased yield, on the average for six years, over the White Transparent of 38 per cent., and over the B. 6450 of 8·5 per cent.

In the summary of results it is pointed out that, owing to some of the newer varieties giving better yields than the White Transparent, most of the planters in the red soil districts have now discontinued growing this cane, and consequently, this year, the results of the different varieties have been compared with B. 6450, which is now being used as a standard cane in place of the White Transparent. The average yields of the plant canes were as follows: B.H.10 (12) from 127·5 acres, 37·82 tons of canes per acre; Ba. 6032 from 77·5 acres, 36·38 tons of canes per acre; B. 6450 from 262·5 acres, 31·3 tons of canes per acre; B. 6308 from 12 acres, 30·96 tons of canes per acre—and B. 376 from 216·75 acres, 27·85 tons of canes per acre—differences in favour of the B. H. 10 (12) and Ba. 6032 as compared with the B. 6450, of 6·52 and 5·08 tons of canes per acre, respectively. The B. 6308 and B. 376 yielded ·34 and 3·45 tons of canes per acre, respectively, less than the B. 6450.

MARKET REPORTS.

London.—The West India Committee Circular, December 11.

Balata—Venezuelan Block, no quotations ; West Indian Sheet, 4*s* 0½*d*.
Beeswax—No quotations.
Cacao—Trinidad, 125*s*. to 130*s*.; Grenada, 120*s*. to 130*s*.; Jamaica, St. Lucia, St. Vincent, and Dominica, 120*s*. to 128*s*.
Copra—£61.
Honey—Jamaica, 80*s*. to 104*s*.
Lime Juice—Raw, 2*s*. ; Concentrated, no quotations.
Pimento—6*d*.
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T S. Garraway & Co., February 3.

Arrowroot—$9·00 per 100 lb.
Cacao—No recent sales
Coco-nuts—$45·00 husked nuts.
Hay—$5·50 per 100 lb.
Onions—$14·00.
Peas, Split—No quotations; Canada, Market bare.
Potatoes—$6·00 per barrel
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, November 25, 1919.

Bay Oil—18*s*.
Lime Oil—Flat, at 3*s*. 6*d*. for West Indian distilled, and 11*s*. for hand-pressed.
Orange Oil—West Indian sweet, 17*s*. 6*d*. bitter, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., January 6.

Cacao—Venezuelan, $26·00 ; Trinidad, $23·50.
Coco-nut Oil—$1·75 per gallon.
Coffee—Venezuelan, 21c. per lb..
Copra—10c. per lb.
Dhal—$12·00 to $13
Onions—$10·00 per 100 lb.
Peas, Split—$12·00 per bag.
Potatoes—English, $6·00 per 100 lb.
Rice—Yellow, $12·00; to $13·00 White, $12·00 per bag.
Sugar—American crushed, no quotations.

New York.—Messrs. Gillespie Bros & Co., January 13.

Cacao—Caracas, 21c. to 21½c.; Grenada, 20½c. to 21c. ; Trinidad, 20½c. to 21c.; Jamaica, 18c.
Coco-nuts—Jamaica selects, $72·00; Trinidad $72·00; culls, Jamaica, $48·00 ; Trinidad $85·00 per M.
Coffee—Jamaica, 20c. to 27c. per lb.
Ginger—21c. to 25c. per lb.
Goat Skins—Jamaica $1·60; Antigua and St. Kitts, $1·50.
Grape Fruit—Jamaica, $1·75 to $2·00.
Limes—No market
Mace—No quotations.
Nutmegs— No quotations.
Oranges—$2·25 to $2·75.
Pimento—10¼c. per lb.
Sugar—Centrifugals, 96°, No market ; Muscovados, 89°, No market ; Molasses, 89°, No market.

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AGENTS FOR PUBLICATIONS OF THE IMPERIAL DEPARTMENT.

London: Messrs. Dulau & Co., Ltd., 34-36, Margaret Street, Cavendish Square, W.
West India Committee, 15, Seething Lane.
Barbados : Advocate Co., Ltd., Broad Street, Bridgetown.
Jamaica : The Educational Supply Company, 16, King Street, Kingston.
British Guiana : The Argosy Co., Ltd., Georgetown.
Trinidad: Messrs. Muir-Marshall & Co., Port-of-Spain.
Tobago: Mr. C. L. Plagemann, Scarborough.
Bahamas: Mr. H. G. Christie, Board of Agriculture, Nassau
Grenada: Messrs. Thos. Lawlor & Co., St. George.
St. Vincent: Mr. J. D. Bonadie, 'Times' Office.
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Montserrat: Mr. W. Robson, Botanic Station,
Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre.
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 801, Yonge Street, Toronto

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A FORTNIGHTLY REVIEW

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High Exchange and Corn Production.

THE present position of affairs with regard to the high rate of exchange in the New York money market against remittances from the West Indian islands, which amounts at the present time to more than 40 per cent., leads to some reflections as to how this burden upon the pecuniary resources of the West Indies may to some extent be alleviated.

In the previous issue of this Journal it was pointed out in the editorial that inadequacy of the local food-supplies appeared to be imminent, and that immediate steps to avert such a condition ought to be taken.

Probably the imported food commodities most important to these islands are Indian corn or maize, and corn meal. Corn is largely used in the feeding of all kinds of stock, and meal forms a considerable part of the staple food of the inhabitants. Although Indian corn is grown to some extent in all of these islands, they consume far more than they produce. In Barbados alone, in the year 1917, the imports of corn amounted to 2,080,343 lb., valued at £15,602, and during the same year 32,759 bags of corn meal were imported, of the value of £32,759. These figures are taken from the Barbados Blue Book, 1917-18.

The figures given above, which are only for one island, are sufficiently surprising. And when it is considered that similar relatively large importations of these articles are made throughout the West Indies, the total would be not only surprising, but astonishing. It must also be remembered that this importation is chiefly from the United States. It is evident, therefore, that, with such a high rate of exchange against these islands, the cost of these staple food commodities has enormously increased. A merchant importing, say, £100 worth of corn or corn meal, would have to pay, roughly speaking, £140 in the New York marke When to this is added duty at the rate of sixpenc per 100 lb., together with freight charges, etc., it will be seen that corn and corn meal can scarcely be sold in the local market at much less than double the price at which they are quoted in the New York market reports. To take a concrete instance: corn meal is quoted at present in the New York market at $3·75 per 100lb. For every 100 lb. of corn meal, worth $3·75 in New York, the local merchant has to transmit under the present rate of exchange $5·25. To this must be added

freight, duty, handling, and commission, which would probably bring the total cost to about $7·00. It may be remarked that in Barbados, at the date of writing, corn meal is being sold at about $6·50 per 100 lb. This lowering of price appears to be due to the fact that a certain amount of corn produced in Barbados and in the neighbouring islands has been put on the market.

The above statistical considerations seem to lead to the inevitable conclusion, that it would be pecuniarily profitable for planters in the West Indies to cultivate extensively crops of Indian corn. There is always a large and steady demand for this article, and under present conditions it might be produced and marketed in large quantities without any fear of its being undersold by the imported article. In addition to this, as was remarked above, the danger of an inadequate supply of foodstuffs would be averted.

Moreover, from an agricultural point of view there are some advantages in the cultivation of Indian corn. First, the crop occupies the land for a short time only—generally about four months; secondly, it is a useful crop in a rotation system of planting; thirdly, the cost of its culture is small, seeing that nearly all the work might in most cases be performed by animal-drawn implements.

It is true that there are certain disadvantages as well. Corn, to give the best results, must be planted in well prepared and manured land, and planters generally believe that when used as a catch crop immediately preceding canes, it is apt to affect adversely the cane crop, because of its exhausting effect on the soil constituents, thus rendering subsequent additional fertilization of the lands necessary. West Indian planters also look with a rather suspicious eye on corn, because it is known to be attacked by some of the insect pests and fungus diseases that infest canes, and also by certain insects, e.g. the cotton boll worm and the corn ear worm, that are injurious to cotton.

Probably, however, the chief objection formerly in these islands to the production of corn on a large scale has been the difficulty of curing and storing the grain. If reaped before thoroughly ripe, especially if the operation has been conducted in damp weather, the corn is likely to mildew; furthermore, the stored grain is liable to be attacked by several species of grain-infesting insects.

These latter objections are nowadays entirely removable. The Government granaries in St. Vincent and Antigua, to cite instances which have been frequently alluded to in recent issues of this Journal, have demonstrated that corn can be dried and stored successfully, even under somewhat wet conditions of climate, and what is more, that it can be protected in bins from the attacks of weevils and other pests.

It would appear, therefore, that by adopting similar co-operative granaries in the various islands, an excellent quality of locally grown corn might always be available for local consumption. In fact it has been demonstrated in St. Vincent that not only has a sufficient quantity of corn been produced and stored to provide for all local cousumption, but that some has been available for export. The consequence of such an extension of corn growing would not only reduce the expenditure on imported corn, but would lead to the supplying to the inhabitants of these islands with a foodstuff which is most important, at a reasonable price, and yet a price which would be profitable to the producer.

In addition to curing and storing grain, such co-operative granaries might well be provided with machinery for grinding the corn into meal. Freshly ground corn produces a palatable meal, of good flavour, and of excellent food value. Owing to the presence of a large amount of oil, which is principally contained in the germ of the grain, such a meal does not keep for a very long time, since the chemical changes induced in the oil impart an unpleasant rancid flavour to the meal after a time. When dealt with in large quantities, as in the United States, before grinding, the grain is passed through a special machine called a 'degerminator', for the purpose of removing the germs. Such a machine would necessarily have to be attached to any plant erected for the purpose of producing meal capable of being stored and shipped.

The preparation of corn meal, however, for local use might well be considerably extended, and that profitably. It is true that the meal would have to be consumed within a moderate time after grinding; but when thoroughly kiln-dried, corn is used in the production of meal; this will keep in good condition for quite an appreciable period. In most of these islands orders delivered to the granary for comparatively small amounts could be filled at short intervals, so that the difficulty arising from this need not be serious.

An endeavour has been made in the above paragraphs to show that the extension of corn growing would not only be beneficial, but profitable to these

islands, especially under present conditions. The methods of corn cultivation are well understood, and succinct information on the point has been published by the Imperial Department of Agriculture for the West Indies.

The main argument of the present article is that, in addition to such natural advantages as these islands now offer in the matter of corn growing, the high rate of exchange now obtaining offers a premium on locally grown corn of some 40 per cent., while, when the cost of freight, together with duty and other charges is taken into account, the protection accorded to locally grown corn amounts to much more than 50 per cent. at least, and that on an otherwise unusually high price. With these advantages in favour of its cultivation, it is evident that every effort should be made to grow corn in these islands.

THE CARBONATION OF BURNT LIME IN SOILS.

A paper on the above subject by Dr. Walter Hoge MacIntyre, of the University of Tennessee Agricultural Experiment Station, was published in *Soil Science*, May 1919. The general introduction to the paper reviews the question of liming in so striking a manner that its reproduction will doubtless prove interesting and profitable to readers of this Journal.

It is to be remembered that the subject dealt with in the investigation is not the general question of the advisability of applying lime to soils, but the conversion, after application to soils, of quicklime or slaked lime into carbonate of lime:—

The practice of applying burnt lime to soils has long been followed as one of the fundamental agricultural arts. Partilarlcuy is this true in European countries. The scientific principles involved in the practice are however, of but recent and partial development. From modern investigations, more particularly in the laboratory, it is now known that the benefits derived from the use of lime are due to its effects upon conditions, physical, chemical and biological. The amelioration of unfavourable physical conditions ; the eradication of various chemical soil constituents of an acid or toxic nature; the supplying, directly or indirectly, of plant food requirements ; and biological betterment have been urged as compelling independent or collective reasons for the application of lime to soils. Even in some newly cleared virgin soils liming is found to be shortly or immediately a profitable treatment; while in the rejuvenation of worn out and abandoned soils, liming is often found to be a prerequisite.

With the advent of improved appliances and machinery for tillage, and with the development of more intensive cultivation, the transported calcareous soils of more recent origin are now more rapidly depleted of their lime contents. Better aeration results in greater oxidation of soil organic matter, and it follows that the soil solution will become richer in carbon dioxide. Thus a stronger solvent will be furnished for the dissolving and leaching of mineral calcium carbonate, or for the hydrolysation and leaching of other forms of lime. Data upon this phase of the subject have been reported by Hall, who states : 'The Rothamsted soil which at the beginning of the nineteenth century must have contained something like a hundred tons of chalk per acre, has now less than fifty, and many other soils which started with a smaller initial stock are beginning to run dangerously short.' Additional data concerning the conservation of lime have been reported also from various American agricultural stations, and by Gilchrist and others.

The development of modern crushing machinery and the advent of by-product limestone have given a healthy stimulus to the use of lime in the form of ground rock. As a result the term 'liming' has become a synonym for application of either burnt lime or ground limestone. In ancient times the soft chalks of Europe were dug and made available by being brought to a state of fineness through exposure to the disruptive action of weathering.

The application of either burnt, air-slaked or water-slaked lime to soils is followed by the phenomena of absorption and carbonation in sequence, or in the reverse order. The existing soil moisture conditions, and the manner of applying or incorporating will be the deciding factors in determining the order of the changes. If the application is in excess of the immediate absorption coefficient, formation of calcium carbonate from the unabsorbed lime will ensue. The term 'immediate lime absorption coefficient' is here used because of the fact that it has been shown by the writer that there occurs a progressive decomposition of calcium carbonate and absorption of calcium by soil, when soil and calcium carbonate continue in contact under moist conditions. This slow, continued absorption, subsequent to the initial rapid absorption, may continue over a period of years. The phenomenon has also been demonstrated by Bouyoucos and Laudeman in a different manner over shorter periods. Therefore an ultimate quantitative chemical comparison between the activities of burnt lime and natural lime rock in soils may well be based upon periodically determined occurrences of $CaCO_3$. Such a requirement necessitates a careful study of the factors influencing or controlling the carbonation of burnt lime in soils.

A lengthy study of the subject then follows, as the result of which it is stated that :—

The experiments as a whole point to certain definite facts which have practical application. Among these are the following :—

1. CaO and $Ca(OH)_2$ in 2-to 4-ton applications will revert to the carbonate more rapidly when left on the soil surface than when mixed with a dry mulch of the moist soil.

2. If an oxide or hydrate application is left on the soil surface for several days prior to inworking, the treatment is in effect an application of finely divided $CaCO_3$.

3. Surface applications of oxide and hydrate will, for the most part, revert to the carbonate more rapidly during humid atmospheric conditions.

4. If the oxide or the hydrate is incorporated with the upper zone of the soil, prior to a more thorough dissemination throughout the soil, the concentration thus effected will bring about in the treated zone a temporary and partial s erilization which may have certain beneficial results.

5 The avidity or affinity of CaO is for moisture, and when this is furnished by the aerial and soil atmosphere, and by soil moisture, there is no tendency to effect any chemical disintegration of soil organic matter.

6 Neither CaO nor $Ca(OH)_2$ can be considered as chemically destructive of soil organic matter when used in the manner and in the amounts to be considered as practical applications.

THE PROPAGATION OF SOME TROPICAL FRUITS.

The following paper has been written for this Journal by Mr. R. S. Cunliffe, B.Sc., at present Delegate for the West Indies of the Chilean Nitrate Committee. He was previously on the staff of the Cuban Government Agricultural Experiment Station at Santiago de las Vegas, and has had considerable experience in tropical fruit growing. The present article deals chiefly with the propagation of avocados. Mr. Cunliffe, however, has promised to supply notes on the propagation of other tropical fruits at some future time:—

To anyone conversant with tropical crop conditions, it is well known that the tropical regions of the world constitute a vast storehouse of material capable of development for the use and well-being of the human race. Amongst other products this is true of the large variety of tropical fruits known to exist, many of which are capable of commercial development, when the necessary knowledge, energy, and capital are diverted towards that end.

The present day status of the citrus industry, with its wonderful development, expansion, and organization, especially in Florida and California, is fairly well known, but perhaps few realize that such arose from small beginnings, and it has only been through determined and long-continued effort along the lines of production of a high-class quality of fruit, in large quantities, of uniform grade, backed by a high degree of scientific marketing organization, that the industry has become such a source of wealth to the population of these States.

That there are several varieties of tropical fruits capable of at least some degree of commercial exploitation seems reasonable. In fact, fruits like the mango and avocado have already made some progress in that direction, and endeavours have been made for a number of years in the southern sections of California and Florida, and to some extent in Cuba and Porto Rico, by planters and others interested, as well as by the United States Department of Agriculture, to initiate a tropical fruit industry, and with considerable success. The fact that California already has its 'Avocado Association', which holds regular meetings and issues literature and other information likely to prove of value to its members, is evidence of the progress made. Such organizations, as well as the Department of Agriculture, have for some time maintained skilled scientists as travelling specialists, who from time to time visit different tropical countries in search of desirable varieties likely to fill the requirements of a modern tropical fruit industry, and, on finding such, propagating material is forwarded to such centres as the Sub-Tropical Laboratory, Miami, Florida, where its merits are tested, and the product in trees and fruit kept under observation until their true value is determined.

If a West Indian fruit industry is ever to be developed on a sound economical basis, it must be by pursuing similar methods to those outlined above. Fruits of value are doubtless to be found in some of these islands, but to be of value to the colony such must be isolated and propagated by modern methods, and probably tested against the best varieties imported from abroad, before any real knowledge of their commercial possibilities can be obtained. The best men to undertake such work are undoubtedly the officials of the several Departments of Agriculture, as they have training and facilities that are sometimes hard to duplicate elsewhere —the Department of Agriculture of Trinidad and Tobago has already made some efforts in this direction. There is no reason, however, why individuals whose inclination leads them to take an interest in such matters should not do considerable work in the propagation of varieties of such standard fruits as mangoes and avocados. It is to encourage such endeavour that the following notes are submitted, as frequently a little explanation on points of practical detail results in the removal of difficulties that previously have presented obstacles to success.

There are considerable differences to be found in the avocado in habit of tree growth, foliage, and fruit, in the different regions where the tree is found growing more or less indigenously. In fact some of such differences are so pronounced as to constitute a question as to whether there are not several species existent. For practical purposes however, it is sufficient to arrange the trees into three groups. First is the so-called South American or West Indian group, to which belong all avocados commonly found in these islands, and such imported varieties as 'Trap' and 'Pollock'. The fruits of this group vary considerably in size, shape, colour, and other characteristics. The skin is thin, smooth, and leathery. The flesh is variable in amount and quality, and the size of the seed and seed cavity is far from uniform; in many fruits the seed does not fill the cavity. The season of maturity also varies greatly in individual trees. The Guatemalan group as found growing in the highlands of Guatemala and the contiguous territory is quite distinct, with its large-leaved, dark-green foliage. Typical fruits of this type are characterized by their hard rough shell, flesh of rich nutty flavour, and tight-fitting seeds. This group is much more resistant to cold than trees of the West Indian type, which are decidedly tender. This fact, coupled with the hard protective shell and good quality, promises considerable future success for this division as an orchard fruit in the Southern United States. A large number of these have now been isolated, and are being tested under orchard conditions for their commercial worth. Intermediate in many characters between these two groups is the Mexican type, found principally in Mexico. The fruits are inclined to be small, and the trees bear in early or mid-season. The foliage is lighter green than that of the Guatemalan group, and approximates more in general appearance to that of the West Indian trees. The leaves, however, have the characteristic 'anise' odour peculiar to the type when a leaf is bruised between the fingers, which distinguishes the trees from the other types, and which in some cases extends to the fruits. 'Northrup' is an example of this group.

The only process of propagation of commercial value with this tree is by budding or grafting. The latter is usually accomplished by the approach method, which is the simplest form; but other grafting methods are in use under special conditions. This method is open to the objection that it is slow, and requires considerable propagating material. As is the case with citrus trees, avocados are now budded commercially by the 'shield' method, which takes the pre-eminent place on account of the ease and rapidity with which large numbers of trees may be worked.

When budding different varieties of avocados it is necessary to study the characteristics of each variety, especially with regard to the selection of budwood, as they are not all alike This, which constitutes one of the difficulties to the beginner, must be learned by experience and observation. The stocks should be budded as soon as they are large enough to work without spliting the bark, say, at the diameter of a lead pencil, and the buds should be inserted at not more than 2 or 3 inches from the soil.

Budwood of the variety it is desired to propagate is selected from young tipwood. This should not be angular, as such wood is usually too soft, but should have assumed a more or less roundish form. The bark must be green, and the wood free from evidences of having become too hard and dry. The buds must be plump and well developed, and they must not have reached the stage where one or more of the bud scales have dropped. Such buds will eventually dry up and fall out, even if the shield should form a union with the stock. Neither must the buds show signs of starting into growth by the partial opening of the bracts, as such do not make satisfactory budding material. On the average stick of budwood several inches long, there may not be more than three or four good buds; the others should be discarded. The tipwood is cut from selected trees, and the leaves removed leaving ½ inch of the petiole adhering, which serves as a handle to facilitate insertion of the bud.

For use with very young stocks, the bud shields are cut about 1 inch long, and it is essential that a very sharp budding knife be used (razor sharp), and this must be kept bright and clean while working. A dull or dirty tool will greatly increase the percentage of failures. The wood of the avocado has a tendency to tear or split, therefore, in addition to using a knife with a very keen edge, the blade should be held obliquely to the axis of the bud stick, making a clean cut from below upward, that is free from any suspicion of tearing the tissues.

The buds are inserted in the usual 'T' incision in the bark of the stock. They may be inserted upwards or downwards. For practica purposes the latter is preferable, as it facilitates other parts of the operation and subsequent manipulation. The vertical cut should be ½ inch larger than the bud shield, and the shields are inserted without using the handle of the budding knife to raise the bark. The tissues of young stocks are very tender, and any unnecessary handling is liable to injure the cambium layer, and result in failure.

Fig. 1. Budded Avocado Pears

The best binding material is soft cotton twine, such as is used in the stores for tying parcels. It is cheap, easy to manipulate, and fastens without knots, and without danger of afterwards slipping and allowing premature opening of the cut. Waxed cloth is not suitable for use with young stocks.

Buds should show in about ten days time whether they have 'taken' or not, and at this time all doubtful buds should be removed and replaced by others inserted in a cut made on the opposite side of the stock. When the buds have germinated and are firm, and from ½ to 1 inch long, the tip of rapidly growing stocks may be removed to check upward growth and force the sap into the bud. At this time the bindings should be examined, and if cutting into the bark by reason of the rapidly swelling buds, they should be loosened, but not sufficiently to permit of the opening of the cut before sufficient callus has been formed.

When the bud has made a growth of 5 or 6 inches, the stock is cut back to 6 or 8 inches above the union, care being taken to leave two or three good buds with their adhering leaves on the stock above the bud insertion to prevent dying back of the stock and probable loss of the bud. The portion of the stock left above the bud is conveniently used as a stake to which the stem of the young bud is tied to ensure a symmetrical upright growth, and a well-formed tree. All buds on the stock which show a tendency to grow, either above or below the union, must be removed to avoid injury to the young shoot. After the bud has made several 'flushes' of growth, and the wood in the neighbourhood of the union is well matured, the stock may safely be cut back to close above the point of insertion, dressing the wound with some antiseptic paint to prevent possible decay.

Budded stock raised in this way may be set out in permanent positions at eight months to a year old.

Seed grafting of the avocado is applicable to some conditions, and is practised by sprouting the seeds in a bed of clean river sand. When the shoots are 3 or 4 inches long, the seeds are raised from the bed, and the cotyledons separated, and to one of these the embryo and shoots will be left adhering. The young growths are cut off at the level of the top of the seed. The largest and most vigorous of these is then flattened on the exposed side by removing a section about 2 inches long with a keen-edged knife, and a corresponding surface is prepared on a young tip branch about 3 inches long, selected from the variety it is desired to propagate. The two surfaces are placed in contact, and the other half of the seed replaced, and the whole secured with soft string or a rubber band, and the seed replanted in the sand bed. All growth arising from below the union must be kept cut back. The tipwood used for this operation should be harder and more dormant than that employed for shield budding. In the West Indies the method is chiefly of value as providing a means of utilizing propagating material that is unsuitable for shield budding; the failures, if permitted to throw up shoots, may afterwards be budded in the ordinary way.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. According to notes received from Mr. R. O. Williams, Superintendent of Agriculture plant distribution during the month of January was as follows: onion seedlings, 4,200; grape vine, 1; ornamental, 23; grafted mangoes, 2; horse beans, 1,700 lb. In addition, 1 packet of seeds and 3 bundles of cuttings were sent out. Regarding staple crops, it is mentioned that large gatherings of cacao are still being made. In regard to the sugar crop, grinding has started in some localities; the local price for sugar is *4d.* per lb. The corn crop is moderate; the local price is now 12*s.* to 14*s.* per barrel. Mealy-bugs and black ants, as well as thrips are reported troublesome in isolated areas at Gouyave estate. Black ants are being treated with crude oil applied to the nests. This and spraying with Bordeaux-nicotine for thrips was stated to improve matters. The appointment of a committee to consider the question of the increased production of ground provisions is recorded. The rainfall registered at Richmond Hill during the month totalled 4·86 inches.

ST. VINCENT In the Botanic Gardens and Experiment Stations work in December was of the ordinary routine character. Plant distribution included 51 coco-nut, 21 miscellaneous, 1,021 cane cuttings, 200 sweet potato cuttings, and 1 oz. onion seeds. The cane crop in the island, Mr. Jackson says, is in good condition; he estimates the return per acre at 20 tons for plant canes and ratoons As regards cotton, there is prospect of a fair second picking, if good weather is experienced. Cotton stainers made their appearance in limited numbers in some few localities. Normal crops of arrowroot and cacao are being reaped. At the Cotton Ginnery, 71,153 lb. of white and 10,419 lb. of stained cotton were purchased, while 203,300 lb of seed-cotton were received for ginning and 32,346 lb. of lint ginned. At the Granary, 9,809 lb. of cob corn and 6,468 lb. of shelled corn were purchased, and 101,274 lb. of corn kiln-dried. The rainfall at the Botanic Station during the month was 7·20 inches, and at the Experiment Station, 7·28 inches.

DOMINICA. The crop reaped in the Lime Experiment Station during the month of January was 215 barrels, making a total for ten months of 1,665 barrels of lime. The total receipts to date were £598 12*s.* 8*d.*, giving an average of 7½*d.* per barrel. Plant distribution comprised 1,250 limes, 125 cacao, 100 vanilla, 67 budded citrus, 1 grafted mango, 80 miscellaneous, 1,650 sugar-cane cuttings, 7,700 onion seedlings, and 171 packets vegetable seeds. The Curator, Mr Joseph Jones, states that the local price of ripe limes rose from 6*s.* to 6*s.* 6*d.* per barrel. Raw lime juice remained at 10*d.* per gallon. The London quotation for concentrated lime juice rose from £38 10*s.* to £41. Good estate cacao is in active demand locally at 102*s.* per cwt. The total receipts of the Agricultural Department from all sources, for ten months ended January 31, amounted to £1,029 13*s.* 9*d.* Mr. H. A. Ballou, Entomologist on the staff of the Imperial Department of Agriculture, arrived in Dominica on January 7 and left for Antigua on January 11. During his stay in Dominica Mr. Ballou visited the Botanic Gardens and Experiment Station, and also the Soufrière district to investigate certain insect pests of lime trees. Fine weather prevailed during the month; the rainfall equalled 7·54 inches.

ANTIGUA. Plant distribution during January included 40,150 cane plants, 146 packets vegetable seeds, 12 packets flower seeds, 11 packets sugar-cane seeds, 21 coco-nut seedlings, 6 decorative plants, 8 lb. Bread-and-cheese seeds, 12lb. Sudan grass seeds, 5lb. lime seeds, and 5 packets castor seeds. Under the influence of continual showers the young cane crop is making rapid growth. The late planted cotton in some districts also presents a fine aspect, and gives every promise of good returns. Regarding pests, Mr. Gallwey states that observations in connexion with grubs of hardback beetles have been continued, special visits being made to certain districts by Mr. Ballou, Entomologist of the Imperial Department of Agriculture, and Mr. Eldridge. During the month 1,181½ lb. of clean and 75¼ lb. of stained seed-cotton were purchased by the Cotton Growers' Association, the total quantities bought to the end of the month being 10,254½ lb. clean and 346¾ lb. stained. Of this amount, 5 bales of clean lint have been sold on the local market at the rate of 4*s.* 6*d.* per lb. The rainfall for the month was 2·55 inches.

From a short report on Agricultural Instruction for the month of January, it is gathered that the reaping of cotton on peasants' holdings is near completion. The price paid for seed cotton at present is 1*s.* per lb. for clean and 3½*d.* per lb. for stained. Leaf-blister mite is very common on these holdings, and peasants have been advised to destroy by burning, all plants which have been attacked so as to suppress the pest. Good returns are being realized by the peasants from their crops of corn, 10*s.* to 18*s.* per cwt. being obtained for cob corn.

Items of interest in connexion with the Government estate, Barbuda, are also to hand, from which it appears that good yields of cotton are expected in certain districts; attacks of cotton caterpillars were controlled by repeated dustings of Paris green and lime. Good weather was experienced throughout the month of January, the rainfall—4·2 inches—being well distributed.

ST. KITTS. During the month of January usual routine work was carried on in the Botanic Gardens. Plant distribution was as follows: 47 ornamental, 13,300 cane cuttings, 700 lb. peas, 14 lb. Guinea corn. Regarding staple crops, Mr. Shepherd states that the good rains during the past month have improved the condition of the cane crop, especially the ratoons, and prospects of a bumper crop are assured. Reaping operations at the Sugar Factory were timed to commence on February 2. The young cane crop is germinating well in consequence of the good showers, and supplies will now be available. Greater attention is being paid on most estates to the selecting of cane plants, and planting only from vigorous and healthy parents. Cotton picking in the Valley district has been completed, and the cotton plants are being turned in to meet the date of the close season on February 15. In the Northern district planting will begin on February 1; the seed to be used has all been obtained from selected seed at the Government Cotton Farm. An outbreak of a disease causing partial blindness amongst working cattle on a certain estate, is recorded. This is attributed to bad sanitary conditions of pens and stables: it has not spread to other estates; the affected animals are said to be improving. The rainfall for the month was 5·26 inches.

NEVIS. Mr. W. I. Howell, Agricultural Instructor, writes to say that the plots at the Experiment Station have all been weeded and kept in good order during the month of January. Plant distribution included 17,000 sweet potato cuttings. In connexion with staple crops it is stated that the cane crop throughout the island is looking fairly well, but will be a late one, as very few fields are showing signs of ripening. The young crop is germinating well, and planting is almost completed. The reaping of the second crop of cotton is in progress but poor yields are being obtained. The cotton stainer is very plentiful, and the percentage of stained cotton high. The sweet potato crop is being

reaped with good returns, and there is a ready market. The rainfall for the month was 3·71 inches.

BRITISH VIRGIN ISLANDS. Every effort to establish and extend the onion plots at the Experiment Station, Tortola, was made during the month of January, and approximately ¾ acres are under cultivation ; growth has been very promising, and record returns are anticipated. A sweet potato plot was reaped, variety North heading the list with a calculated yield of 16,000 lb. per acre. The demand for onion plants is evidenced by the fact that 92,000 were distributed from the Station. In addition, 84 decorative plants were sent out. Orders for 2,500 coco-nut and 3,500 lime plants have been received from Tortola, while from Virgin Gorda came an order for 550 coco-nut plants. Much importance, writes Mr. Gomez, the Curator, is attached to the further development of the coco-nut industry in the Virgin Islands, as the successful growth of the plant is now well known to be admirably adapted to the soil and climatic conditions of these islands. Touching staple crops, it is stated that up to date approximately 80 bales of cotton have been purchased, 50 bales of which were shipped to St. Kitts and sold at the high rate of 4*s*. 6*d*. per lb. The cotton fields have responded to the good rains received, and a good second crop is anticipated. There has been an increase in the area under cultivation in sugar-cane. The various mills were busy during the month, and the sugar made found a ready market at abnormally high rates. Lime trees are bearing very fair crops all over the island, and it is to be regretted that there is no market at present for this produce. Storm-damaged trees are now recovering and promise good returns Cotton stainers are still in evidence in the West End of Tortola and in Jost Van Dykes. The importance of controlling this pest is now more keenly noticed. The rainfall during the month was most evenly distributed, and enabled all agricultural activities to be pushed ahead to the very best advantage. The record was 4·24 inches.

CURING VANILLA.

Bulletin No. 26, Porto Rico Agricultural Experiment Station, on the subject of vanilla as a promising crop for cultivation in Porto Rico, contains very clear directions as to the method in which vanilla beans were cured at the Station. This subject has received considerable attention in some other parts of the West Indian islands, and it seems advisable to reproduce most of that portion of the bulletin referred to above.

The pods were placed in a wire basket, and dipped three times in water heated to 80° to 85°C., being first immersed for ten seconds, then for twelve, and finally for fifteen seconds, with thirty second intervals between dippings. While still hot, they were closely wrapped in blankets and left to sweat over-night. As the quantities dealt with were small, artificial heat was used to aid in sweating. The bundled pods, having had scalding water poured over the blankets, were put into an electric incubator set at about 43°C., but as the incubator failed to maintain a uniform temperature in accord with the regulator, this was only an approximation of the actual temperature. The following morning the pods were spread on blankets in the sun. In the afternoon they were spread on shelves in the incubator and so left until the following morning, when they were again sunned; in this and subsequent sunnings the beans were covered with a folded blanket. This drying was continued for three or four days, alternating between incubator and sun. After that the drying was completed on open shelves within doors at ordinary temperature. This process gave excellent results, the pods curing up well and crystallizing beautifully in drying.

In dipping a thermometer must always be used, as the temperature has a most decided effect on the curing.

Rabak states as follows : 'Curing the beans at room temperature either without previous treatment or after treatment with water up to 90°C. for a short period of time, apparently produces beans of the best quality, as judged by the flavouring extracts prepared from the samples. It is, however, essential that the temperature (of the water) be not sufficiently high to destroy the action of the oxidase which is present in the pericarp. A destruction of the ozidase would seriously interfere with the formation of the ordorous constituents of the cured beans.'

Dean and Schlotterbeck state 'that the production of vanillin in the bean is an enzyme action has been shown by obtaining two green beans from Mexico and heating one to 80°C. in order to destroy the natural enzyme present, and then submitting both beans to a curing process. The bean which had not been heated produced vanillin, while the heated one did not.'

Of course, immersion in water heated to 80° or 90°C. for short periods does not raise the beans to this temperature It should be borne in mind that the relation between the volume of water and the quantity of beans dipped must be such that the dipping will not reduce too greatly the temperature of the water.

While hot, the beans are placed in a close receptacle to sweat. Some growers use half-hogsheads with close-fitting wooden covers the beans being first wrapped in blankets. Sweating continues until the following mofning or even the morning after. It was found in tests at the station that where only small quantities are cured, those wrapped in a blanket and furnished with no additional heat from without, do not retain sufficient heat for proper sweating, and that many beans develop watery blisters. Placing the beans immediately after dipping in a heated chamber to begin the drying process, reduced the blistering to less than 2 per cent., whereas under the system of attempted sweating of small quantities without artificial heat, the blistered pods in the different lots ranged from 20 to 50 per cent.

On removal from the sweating box (in which the beans should have changed to a chocolate colour,) the beans are spread for a few hours uncovered in the sun. After that they may be sunned under blankets for from four to six days. One grower has used a glass house with success, and he considers that this has greatly reduced the expense of curing. Others, instead of sunning, use artificial heat in drying, beginning with a chamber heated to about 110°F. After the pods become somewhat wrinkled, they are removed from this to a less heated chamber for a short period. Whichever process is used for the earlier drying, the curing is completed with pods spread on shelves at ordinary temperature. The pods should be stirred frequently while on the shelves to promote unformity in drying and the removal of mouldy pods.

The important point is to dry sufficiently to ensure good keeping qualities. When sufficently dry, the beans should still be supple, never brittle. One indication of nearly completed curing is that the contents of the pod slip along easily when pressed between the fingers, but the pod should not feel soft and mashy. The time which must elapse between picking and becoming sufficiently dry for storing away varies with the bean. Six to nine weeks would be a fair average time.

EDITORIAL NOTICES.

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Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

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NOTES AND COMMENTS.

Contents of Present Issue.

The bearing of the question of the present high rates of exchange on local corn production is dealt with in the editorial.

On page 52 will be found an interesting article on the propagation of some tropical fruits, especially the avocado.

Under Plant Diseases will be found the first part of a review of recent investigations on the Panama disease of banana.

The carbonation of burnt lime in soils is the subject of an interesting article reproduced on page 51.

The Lister Institute.

This institute, whose headquarters are at Chelsea Gardens, London, was founded in 1892 with the aim and object of studying the diseases of men and animals with a view to their prevention.

In an interesting note in the Descriptive Catalogue of the British Scientific Products Exhibition, 1919, several important results of the Institute's work are described.

One of these is the manner in which scurvy was exterminated among the Indian troops in Mesopotamia during the war. At the beginning of the war those troops suffered very severely from scurvy. This disease is caused by the want in food of certain substances called vitamines. Vitamines occur only in the minutest quantities, but if they are wanting in human food, a variety of diseases, according to which of the vitamines is deficient, result, with probably consequent death.

In Mesopotamia, on account of the difficulty of transport, the Indian troops were at first fed principally on dried grains and pulses—good and concentrated foodstuffs, but wanting in one of the essential vitamines. The result was an epidemic of scurvy. The Government appealed to the Lister Institute for help, and this was at once forthcoming, as the discovery had been made by researches in the Institute that if a dry pea is allowed to germinate, large quantities of anti-scorbutic vitamines are at once formed. All that was wanted was to damp the peas, and expose them to the warm Mesopotamian air for a few hours, when they sprouted, and formed the necessary vitamines. This sprouting did not interfere in any way with the cooking of the peas, and yet, when treated in this simple way, they became a perfectly wholesome food, and the scurvy disappeared.

Preservation of Fruits in Cold Water.

The *Experiment Station Record*, January 3, 1920, draws attention to two articles contributed to *Comtes Rendus*, Paris Academy of Science, by G. Bertrand, on the preservation of fruit in cold water without the addition of sugar, alcohol, or antiseptics. Mons. Bertrand reports that out of forty-seven jars of different fruit canned in cold water, after a preliminary washing but with no further treatment, seventeen were in perfect condition at the end of eleven months. In the other jars there was greater or less indication of alcoholic fermentation, but no evidence of other changes. As a result of this study he concludes that it is possible to preserve fruits by the elimination of air in flasks filled with water, without the necessity of adding sugar or any other substance, or of heating the fruit.

In a further paper Mons. Bertrand advances the theory that the preservation of fruit by the method noted above is due to the action of diastases in the fruit upon the dissolved oxygen originally present, thus rendering the medium anaerobic, and preventing fermentation. The chances of success in the employment of this method are consequently considered to depend upon the number, nature, and degree of vitality

of the organisms present in the flasks, upon the acidity of the fruit, and above all upon the intensity of the biochemical processes which bring about the disappearance of the dissolved oxygen. Cut fruits are apparently better suited to this process than whole fruit, on account of the more rapid solution of the cellular juices in the water.

The Care of House Plants.

Most persons are fond of having at least a few plants growing indoors in pots, whether they be foliage or flowering plants. Sometimes these plants do not thrive because they do not receive the thorough and constant attention necessary for their well-being. As is pointed out in a note in *Seasonable Hints*, November 1919, published under the auspices of the Director of the Dominion Experimental Farms, Ottawa, watering is probably the most important point to be attended to as regards house plants. The soil in the pot should never be left to become thoroughly dry. Watering should be done regularly; in warm climates, especially where the atmosphere is not charged with moisture, daily watering is an excellent rule.

On the other hand, injury will result from overwatering. The pots should not be allowed to stand in water, as the soil in them will thereby become water-logged, and the plants turn yellow and sickly. A very good method of telling whether a plant needs watering is to tap the pot with the knuckles, and if it rings hollow, it is a sure sign that the soil is so dry as to need water. An essential point is to supply pots with good drainage in the form of broken bits of pottery or such like material placed in the bottom of the pots to the height of some inches.

Fresh air is beneficial to pot plants, but not in the form of direct draughts. Tender ferns, for instance, are much more liable to be injured by a strong draught from a window than from direct sunlight. This is often forgotten.

'Job's Tears.'

The grains of the erect annual grass (*Coix Lachryma-Jobi*) are well known in the West Indies under the name of 'Job's Tears.' In these islands they are only used for stringing as beads, their hard, shining, grey covering being distinctly attractive. This plant is widely dispersed throughout the tropics. In India, under cultivation, the grain has become soft-shelled, and usually lighter in colour. In Assam and other parts of India this cereal forms an important food of the hill tribes. In Burma the grains are parched and eaten like Indian corn. According to *Bulletin No. 80*, Department of Agriculture, Federated Malay States, the grains of the cultivated corn are sweet and wholesome, and can be ground into flour. Certain kinds are roasted whole, then husked and eaten whole, or boiled as rice.

The method of planting is to sow the seeds in nursery beds, and to transplant the seedlings when about 6 inches high into the field, spacing the plants about 2 feet by 2 feet. The grain matures in the third month after sowing, and harvesting continues for several weeks. The bulletin above quoted states that the yield per acre would appear to equal, if not exceed, that obtained from maize. The grains are gathered as they ripen, the principal difficulty with the crop appearing to be in husking the grain.

As far as is at present known, these cultivated varieties of Job's Tears do not occur in the West Indies. They might be worth introducing.

Corn Production in South Africa.

It would appear from recent statistics that the production of maize within the limit of the Union of South Africa has enormously increased, of late years, and that the potentional output has great possibilities. There is scarcely any part of South Africa where corn cannot be grown, it is stated in a note appearing in *Production*, January 1920. In some districts it is most prolific. The climate also of South Africa is wonderfully suited to the cultivation of this crop. The harvesting season is prolonged, and in most parts of the Union this period is bright and dry. The result is the production of a very high average quality of grain. Apart from the value of the crop for export purposes amounting to £877,363 in 1916, the extension of dairying and stock raising in the various States of the Union adds to the probability of a similarly great extension in the growth of maize for the purpose of stock feeding.

The Therapeutic Value of Iodine.

A booklet has recently been received at this Office entitled, Farm Therapy with Iodine; it is issued by the Chilean Iodine Producers, New York. The booklet chiefly contains plain directions for treatment of stock on the farm in cases where iodine is of value, and would seem to be useful to stock owners.

The commercial source of iodine up to the middle of the last century was sea-weed, particularly that obtained from the rocks around the Channel Islands; but in later years it has been obtained from many other sources. It is stated that Chilean iodine is obtained in large quantities from the mother liquor resulting from the manufacture of Chilean nitrate.

The use of iodine in various forms for the prevention of infections, and for promoting the rapid healing of wounds has been widely recognized during the war. Among other qualities iodine has the advantage of filming over superficial wounds instantly; thus a scratch or cut is made air-tight, and so the chances of rapid healing are increased.

Iodine is one of the few substances that penetrates unbroken skin, and thus congestion and pain are frequently relieved by its external use, because of its absorption. Iodine should not, however, be administered internally except bythe advice and prescription of a qualified physician or veterinary surgeon.

INSECT NOTES.

THE FOWL TICK.

The fowl tick, chicken tick, or 'blue bug,' as it is called in some of the United States of America, is a serious pest of poultry in parts of the South-Western States; it has also proved a serious handicap to successful poultry raising in the tropics, including the West Indies In *Farmers' Bulletin 1070*, of the United States Department of Agriculture, is presented valuable information concerning this pest, and measures for its eradication, which is here abstracted for the benefit of those engaged in poultry raising in these colonies :—

HOSTS.

The chicken appears to be the preferred host of the fowl tick, and suffers most heavily from its attacks, although turkeys, geese, ducks, pigeons, ostriches and guinea fowls are all subject to attack. In the United States the turkey is the most seriously injured of these latter.

EFFECT OF ATTACK.

The presence of fowl ticks in poultry houses is often not known to the owner until the fowls show marked symptoms of injury, such as weakness in the limbs, extreme leanness, or paleness about the head. If chickens in such conditions are not removed promptly from the source of infestation, or the poultry house treated, they often die in considerable numbers, or are so weakened in vitality that they are rendered easy prey for various types of disease. Another, and probably the main source of loss, is through the reduction in egg production. Fowls in heavily infested houses have been known not to lay an egg for months, and even under the very best conditions as regards feeding and breeds, the egg output is greatly reduced. Fowls raised where ticks have more or less access to them are often stunted in growth. Another source of loss is through the desertion of the nests by sitting hens, caused by annoyance from the ticks.

Death is brought about by heavy infestation, which drains the fowl of blood. This is possibly supplemented by poisonous secretions introduced by the ticks. Death loss is most common in cases where fowls are placed in infested chicken coops which have not been used for several months. In such instances the ticks are extremely hungry, and swarm over the fowls by the thousands. The symptoms are usually weakness in the legs and droopiness of the wings, the chickens being unable to walk or get on the roost. The feathers appear ruffled, and there is usually a loss of appetite, and sometimes diarrhœa. The comb may or may not appear pale. Sometimes death is produced in a day or two. Chickens soon after hatching are often killed by becoming infested with ticks.

LIFE AND HABITS OF THE TICK.

Many of those who are quite familiar with the pest do not know that the small dark coloured objects attached to the skin of the fowl are a stage in the life of the chicken tick, the later stages of which are found almost exclusively in the cracks about the hen-house. In fact there are many times more ticks present about the hen-house than on the chickens. The chicken tick is very similar in its habits to the bed-bug, except in the first or seed-tick stage Ordinarily it is much easier to determine the presence of the pest by examining the ends of the roost poles, or pulling up loose pieces of bark or boards about the roosts, than by examining the fowls themselves. One can usually detect the presence of the tick by looking for spots of black excrement on the wood near the cracks where the ticks are hiding.

The eggs are nearly spherical, brownish in colour, and are deposited in cracks about the hen-house. During warm weather the eggs hatch in from ten to fifteen days, but in cool weather the hatching period may exceed three months. The young ticks which hatch from these have six legs, and are greyish in colour, thus being quite different in appearance from those seen on the fowls, or the older ticks about the roost. They crawl rather rapidly, and sometimes are seen moving about over the roost in the daytime, especially if the weather is cloudy. Ordinarily, however, they only emerge at night, and go about in search of a fowl. They crawl up the legs, and attach themselves on various parts of the body, especially where the feathers are not very dense. The ticks attach themselves in bunches on a host, and usually they are most readily seen on the breast, under the wings, and on the thighs and necks. They attach themselves very firmly by their spiny mouth-parts and begin sucking blood. In a day's time they become somewhat enlarged, and reddish or bluish in colour. They are completely engorged with blood in from a little over three days to about ten days, and as soon as full-fed they let go of the host during the night and crawl along the roosts in search of suitable hiding places. If good protection is not at hand they sometimes crowd together in dense masses. In this stage the seed-tick is about one-tenth of an inch long, and usually dark blue or purplish in colour.

The length of time the fowl tick can survive without food is truly remarkable. Adults have been known to live over two years when confined in tight boxes without any food. In some of the tests, the ticks survived nearly two and a half years, and there is little doubt that in infested chicken houses some of them may survive considerably longer than this, even when all poultry is excluded. The younger stages show slightly less longevity. The seed ticks usually die if they do not find a host in about five or six months, but the nympal stages may live for from eight to fifteen months. From these statements it will be seen that the starvation of ticks by the closing up of a hen-house and excluding the fowls is a difficult matter, and the injury produced by ticks to fowls introduced into houses which have been vacant for a year or so is explained.

HOW TO TREAT INFESTED HOUSES.

Begin in the morning by removing all unnecessary material from the hen-house including nests, roosts, superfluous boards, etc. If these are of no great value it is usually advisable to remove them carefully and place them on a bonfire. If it is desired to keep the boxes they should be placed in a pile ready for spraying. When either crude petroleum or carbolineum is used, it is generally necessary to spray the entire inside of the chicken house. For this purpose it is best to use a good bucket pump with a 10 or 12-foot lead of hose and a good nozzle. It will be found that either carbolineum or crude petroleum will spray better and go farther if thinned with about 1 part kerosene to 2 parts carbolineum or crude oil. The spray should be driven directly into every crack, and the roof well covered as well as the walls. Ordinarily it is also necessary to spray the floor, as some ticks are dropped in removing the roosts, etc. On heavily infested premises it is usual to find every small coop and brooder infested, as well as the large chicken house, and if such is the case, they should either be burnt or thoroughly sprayed.

In using carbolineum or anthracene oil in treating a poultry house which is closely built, it is advisable to keep the fowls out the night following the treatment in order to allow the material to dry in thoroughly, as the fumes from it are liable to irritate the eyes and mucous membrane of the chickens. This precaution is not necessary in the usual open front or loosely built chicken house. After spraying with crude oil it is usually advisable an hour or two after spraying to wipe the free oil off the roost poles and other parts of the building where it may have accumulated and be likely to drip on the chickens.

The number of treatments necessary is dependent largely upon the construction of the building, the number of infested places on the premises, and the thoroughness of the work. If the chicken house can be sprayed thoroughly, usually one general treatment is sufficient with either of the materials mentioned. The crude oil is less persistent than the carbolineum, and unless nearly all of the ticks are reached, it is sometimes necessary to give a second or even a third general spraying when the crude oil is used. In any event it is important to keep a watch on the roosts, and usually advisable, when carbolineum is used to treat them once with a brush about thirty days after general spraying, and give two or three treatments in the same way at twenty or thirty-day intervals if crude oil is employed. Owing to the great longevity of the ticks, and the possibility of some of them being picked up by chickens roosting or laying away from the regular place, it is always advisable to keep watch for a year or two on the roosts and nests, and as soon as any ticks are observed, to give the roosts and nests a treatment with a brush.

PLANT BREEDING EXPERIMENTS IN ST. VINCENT.

From the Report on the Agricultural Department, St. Vincent, for the year 1918-19, the following items of interest are reproduced.

The breeding experiments with cowpeas (*Vigna unguiculata*) alluded to in last year's annual report have been continued. Unfortunately for the scientific aspect of the work, an apparently unrecorded pest has inflicted great damage on the cultures. This pest is apparently the cowpea weevil (*Chalcodermus annuus*). The weevil deposits its eggs in the young pods, with the result that most of the seeds are destroyed by the larvae. The pest has also been observed to attack the wild cowpea (*Vigna luteola*) pigeon peas, and bonavist beans (*Dolichos Lablab*) A long close season during which food plants are not grown, appears to offer success as a measure of control

Hybridizing experiments with bonavist beans have been continued. A summary of the results so far obtained may be of interest. In the cross climber × dwarf, the climbing habit is dominant in the first generation In the second generation, segregation takes place into three climbers and one dwarf. Thus the climbing habit is due to a single Mendelian factor. The purple colour of the flower appears to be due to two independently inherited factors. It may be noted that some of the bush types which have been isolated are extremely vigorous in habit, and promise good results when used as a cover crop.

During the last three years a large amount of breeding work has been carried out on the castor oil plant (*Ricinus* spp). It will be of interest to give a summary of the results.

This well-known plant exists in a wild or semi-wild condition in all parts of the West Indies. A large number of types have been collected, differing in such characters as bloom on the stem, colour of stem and leaf, presence or absence of spines on the capsules, time of maturing, yielding capacity, etc. With one doubtful exception all the West Indian native varieties when taken into pedigree culture, breed true. It is interesting to find a wind-pollinated plant in the condition of a group of 'Elementary species,' but as Dr. White has pointed out (*Journal of Heredity*, Vol. IX, No. 5, 1918), very little cross-fertilization takes place even when conditions are most favourable. Much of the natural crossing in the West Indies is probably due to the activities of the honey bees, which are assiduous collectors of the pollen, and have frequently been observed to bring pollen into contact with the stigmas.

It does not appear that any West Indian native variety is morphologically suitable for commercial cultivation. Certain hybrids between a type known as *Ricinus Gibsoni* and a St. Vincent native varietp have given promising plants in the second generation, and a very prolific type was selected for culture in F_3.

The following field notes on this type may be of interest. Sown on April 25, on ridges 4 feet apart with 1 foot between the plants, flowered in thirty-three days, and produced the first ripe seed in seven-eight days from sowing. The whole was picked by November 16. The plot was approximately one-tenth acre in area, and yielded shelled seeds at the rate of 1,000 lb. per acre. This is equal to nearly 22 bushels per acre.

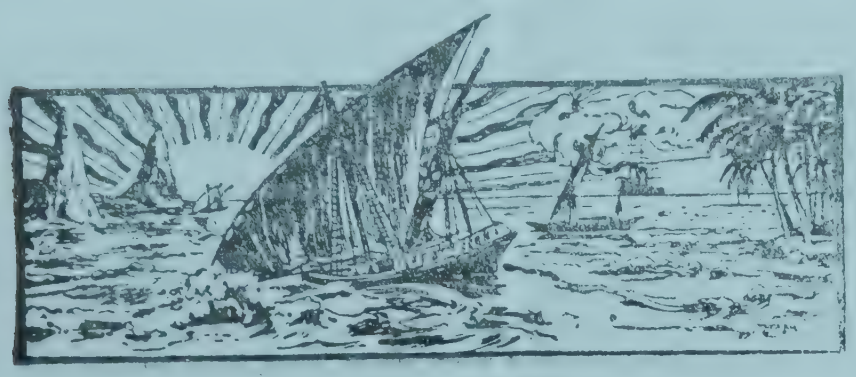
BORIC ACID.

Boric acid, sometimes called boracic acid, is a product found naturally in small quantities in several parts of the world. The pure white acid is now almost entirely produced from the native borates of lime found in North America and Asia Minor.

Pure boric acid is found in commerce in thin pearly crystals, or as a fine white powder. It has very little taste, is inodorous, and is given internally as medicine in doses of 15 grains. It dissolves in about twenty-six parts of cold water, but is much more soluble in hot water. It has the property of destroying the germs which cause putrefaction in flesh, and on this account it is extensively used for dusting over wounds, and in surgical work.

Boric acid is of inestimable value, for the same reason, as an antiseptic, and food preservative, it is stated in Douglas's Encyclopaedia, since by its use in minute quantities the germs which cause meat, milk, and other products to 'turn', or in other words, to become sour, tainted, or rancid, are destroyed, and it is therefore possible to convey butter, meat, beans, beacon, etc. from very distant places to market in a perfectly sweet and fresh state.

Information furnished by Mr. John R. Bovell, I.S.O. the Director of Agriculture, Barbados, shows that the area of Sea Island cotton grown in Barbados from January 1 to December 31, 1919, was a total of 1,179 acres. Almost all of the Sea Island cotton cultivated in this island is in the three drier parishes of St. Philip and Christ Church to the south, and St. Lucy, the extreme northern district.



GLEANINGS.

It is announced that the sugar beet crop in France is turning out better than was expected, owing to the unusually good quality and high sucrose content of the beets. It is now confidently predicted that the sugar outturn will certainly reach 15,000 metric tons, and in some quarters as much as 175,000 tons is expected. (*Facts About Sugar*, December 20, 1919.)

The *Bulletin de l'Association des Planteurs de Caoutchouc*, published at Anvers, in its issue of October 1919, contains an article drawing attention to the great possible extension of banana cultivation in the Belgian Congo. According to this article the conditions in a very large part of that region are extremely favourable for this cultivation, and when transport facilities are improved, the Belgian Congo will be able to place a great quantity of the fruit on European markets.

In the Report of the Department of Agriculture, Ceylon, for the year 1918, it is stated that the large quantities of sea-weed which are to be found in the shallow bays along the coast may prove a useful source of potash. Fresh sea-weed is considerably richer in potash than ordinary cattle manure, containing from 20 to 40 lb. per ton compared with 10 to 15 lb. per ton in the latter. The dried sea-weed contains from 60 to 230 lb. of potash per ton.

It is coming to be recognized that a solution of water-glass (silicate of sodium) at the rate of 1lb. to the gallon of water, is the best chemical preservative for eggs. The best practice is to immerse the eggs in the solution, and keep them there until required for use. It is necessary that the eggs to be preserved should be perfectly fresh and clean, and great care must be taken to exclude defective or dirty eggs, if satisfactory results are to be obtained. The above instruction is quoted from Douglas's Ecyclopaedia.

For the last six years no large vanilla crop has been produced in the Seychelles. Even before that time, and as far back as 1907, vanilla crops were produced at intervals of several years, and the industry began to decline rapidly. The Annual Report on Agricultural and Crown Lands, Seychelles, for the year 1918, states that this falling off is due to the fact that the orchid has been grown for over fifty years in the same soil without manuring, and has been reproduced from cuttings all that time. It is suggested as a remedy that nurseries should be established in which fresh vanilla plants might be grown from seeds.

From the results of trials in the use of rice straw as a mulch for sugar cane, it is evident that it is well worth the while of a sugar planter to make large scale trials with any straw which may be produced on his estate, bearing carefully in mind that the full advantage of this mulching will not become apparent until repeated over several crops. (*Journal of the Board of Agriculture*, British Guiana, October 1919.)

Although it has frequently been stated that formic acid is present in the stinging hairs of the nettle, few attempts at a direct proof have been made. Mr. Leonard Dobbin collected the acid present in a very large number of hairs, by compressing the leaves with filter-paper impregnated with barium carbonate. From an examination of the barium salt formed, he comes to the conclusion that free formic acid does exist in the stinging hairs. (*Journal of the Chemical Society*, December 1919.)

A note in the *Monthly Bulletin of Agricultural Intelligence and Plant Diseases*, February 1919, states that an Italian investigator has found that the composition of coffee dregs as a food for stock compares well with that of maize, coarse bran, oats, and rice bran. Coffee dregs were fed to dairy cows, beef steers, horses, pigs, rabbits, guinea pigs, chickens, and ducks. The food proved excellent for all the animals when fed powdered and very dry. A cow may consume 2·2 lb. per day, but it is best not to give a horse more than 0 8 lb. The dregs are particularly suited to cows and pigs.

To meet the situation arising from the high rate of exchange, some American mercantile firms are seeking orders for goods from merchants in Jamaica payable on sight drafts and at sixty days as usual. As soon as the drafts have been met locally, in order to avoid the cost of remittance, the local American agents purchase island produce with the proceeds of the sale. The produce is then shipped to the United States. By this means the Americans hope to combat the desire of Jamaica merchants to place their orders in the United Kingdom. (*The Times* Trade Supplement, December 20, 1919.)

The amount of sugar shipped from Fiji in 1918 was 63,070 tons as against 97,334 tons in 1917. The decrease was due partly to a drought and partly to reduction in area caused by shortage of labour. As in the previous year a few of the estates given up by European planters continued in cultivation as a result of their being cut up into small blocks and leased to Indian farmers. There has, however, been a reduction of the area under cultivation. As the sugar industry is absolutely dependent on a regular supply of labour, the disorganization of the system of Indian immigration has necessarily resulted in a reduction in the amount of sugar produced. (*Colonial Reports*—Annual No 1,006.)

It is stated by a correspondent to the *Times* January 17, 1920, that a scheme has been prepared to provide several large reservoirs in Jamaica, at a point 16 miles to the north of Kingston to impound water from one of the largest rivers in the island. A portion of the water impounded will be used to generate electricity by means of a turbine plant. The water that passes through the turbine will in turn be used to irrigate lands in lower St. Andrew that are well suited for agricultural purposes. The cost of the undertaking will be about £120,000.

COTTON NOTES.

CLOSE SEASONS FOR COTTON.

In order to control pests and diseases of cotton, the various Governments of the British West Indian islands in which Sea Island cotton is cultivated, have from time to time passed laws whereby close seasons have been established, during which periods all cotton plants must be destroyed, and no new cotton is allowed to be planted.

These close seasons are as follows :—

ST. VINCENT—By Ordinance dated March 14, 1911—the month of April.

BARBADOS—By an Act dated March 27, 1919—from April 30 to May 31.

MONTSERRAT—By Proclamation published December 18, 1915—the month of March.

ANTIGUA—By Proclamation published in January 1920—April 15 to May 15, except the Five Islands District in the west of the island, the limits of which are defined in the Proclamation, where the close season is from July 28 to August 10.

ST. KITTS—By Ordinance dated September 18, 1918—

District A.—approximately the southern part of the island except the Salt Pond District—from February 15 to March 31.

District B.—approximately the north-western portion of the island—from January 15 to February 28.

District C.—approximately the north-eastern part of the island—from December 15 to January 31.

District D.—known as the Salt Pond District—by future Proclamation.

NEVIS—By Proclamation published March 6, 1919—

District A.—approximately the southern part of the island—from April 15 to May 15.

District B—the rest of the island—the month of March.

ANGUILLA—By future Proclamation.

VIRGIN ISLANDS—By an Ordinance of 1920—

Tortola and *Jost Van Dykes*—from March 15 to April 31.

Virgin Gorda—from April 1 to May 31.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended January 10, 1920, is as follows :—

ISLANDS. Since our last circular report, of December 20, the demand for the odd bags classing Fine to Fully Fine has been moderate, resulting in some small sales both for account of the Northern Mills and for export. As the unsold stock of this quality is limited to 300 to 400 bales, the Factors are very firm in their asking prices, refusing to make concessions to sell.

There has been, however, a demand for the Planters' crops of Extra Fine, resulting in sales of six crops, aggregating about 300 bales, at prices ranging from $1·00 to $1·50, buying being on account of French spinners.

We quote, viz:—

Fine to Fully Fine @ 85c., f.o.b. and freight.

Fine to Fully Fine, off in preparation, @ 82c., f.o.b. and freight.

GEORGIAS AND FLORIDAS. The market has been quiet during the holidays, and only small sales have been reported, consisting largely of the lower grades, the buying being on account of the Northern Mills. The shipments, however, to the Northern Mills have been comparatively large, especially so from Jacksonville.

The offering stock is firmly held at quotations.

We quote, viz :—

Average Extra Choice, @ 83c. f.o.b and freight.

The exports from Savannah since December 20 have been, to Northern Mills 272 bales, Southern Mills 89 bales, and from Jacksonville to Northern Mills 2,297 bales.

The United States Census Bureau reports the amount of Sea Island cotton ginned to January 1, as follows:—

South Carolina	3,174 bales	making a total of	6,710 bales
Georgia	650 bales		
Florida	2,886 bales		
against last year,	36,270 bales.	Total crop	44,380 bales.
,, 1918	86,813 bales.	,, ,,	88,174 bales.
,, 1917	113,359 bales.	,, ,,	113,109 bales.
,, 1916	88,921 bales	,, ,,	85,278 bales.

The above report apparently points to a total crop of less than 10,000 bales.

AGRICULTURE IN BARBADOS.

The month of January closed with a rainfall which was most satisfactory. Not only was the total a very satisfactory one, but the distribution was also excellent. In several districts showers fell on twenty of the thirty-one days, so that the soil, if not soaked to any great depth, was sufficiently moist on the surface for the agricultural requirements of this time of the year.

The showers have wonderfully improved the old crop, and the longer reaping operations can be delayed, the better. Gain is on the side of delay, while a very poor juice would be the result of hurry.

There is a very great scarcity of fodder on some estates. In some districts planters are in great straits with the feeding of their animals, and are resorting to the stripping of their poorest fields to get the animals a 'bite' until they start reaping. Pasture lands have not been cared, and the result is that the yield of grass is now much below the requirements of estates Very rarely does one see a vigorous and abundant crop of grass on any pasture of long standing. We have recently seen a few gangs employed in picking the 'carpet weed' from pastures, and we have heard of one estate which has applied a mixture of sheep manure and nitrate of soda to some of its grass land. This is a move in the right direction, and the result will greatly exceed in value the outlay. The shortage of manure on many estates is due to the decline in the amount of material obtained from the pastures, and there is no manure which produces as good results, or which mingles better with the soil and renders it so fertile as pen manure It is also cheaper to feed animals from one's own pasture than to purchase fodder, however reasonable the price may be. But in these days we know that high prices rule in the purchase of every article.

We are rapidly approaching a time when our pasture land must be looked after in a degree proportionate to its importance as a fodder producer, and as a material source of our manure supply.

The young crop is now pretty generally established, and some fields are growing at a rapid pace. The B. H 10 (12) and the Ba6032 are very regular. (The Barbados *Agricultural Reporter*, February 7, 1920.)

PLANT DISEASES.

THE PANAMA DISEASE OF BANANAS.

An important paper by W. Brandes was published in *Phytopathology*, September 1919, recording his investigations, and the results obtained, with regard to the 'Panama disease' of bananas, which he prefers to call 'banana wilt'.

After referring to the importance of banana cultivation in Central America and the West Indies, he describes briefly the methods of cultivation. He then alludes to the variation in the ability of the disease to attack different varieties of bananas. It is a curious fact that, in any particular region, this disease attacks most severely, and sometimes exclusively, the variety which is there most esteemed, and therefore most widely planted. It is also interesting to note that varieties which are strongly attacked in one country appear to be resistant in another, although the disease may be present in great abundance on some other variety.

The reasons given for preferring the name 'banana wilt' as applied to this disease, in place of 'Panama disease' are stated to be: (1) that the disease is by no means confined to Panama, but is widespread in the American tropics; and (2) that it is very similar both in symptoms and in identity of the causal organism to the well-known 'cotton wilt,' 'okra wilt,' 'tomato wilt,' etc., and therefore the name 'banana wilt' is in accordance with the best usage among plant pathologists.

It was in Panama and Costa Rica that the disease first attracted wide attention on account of its destructive nature, having attained alarming proportions in those countries by 1904.

Dr. Erwin S. Smith, in the year 1910, isolated a species of Fusarium from discoloured vessels of diseased material from Cuba, and named the isolated organism *Fusarium cubense*. Other investigators have investigated the disease from time to time, but it appears that the results have been somewhat lacking in accuracy.

The disease has a very general distribution throughout the tropical regions of the world. In the West Indies it has been reported from Jamaica, Cuba, Porto Rico, Trinidad, and Barbados; and there is no reasonable uncertainty as to the identity of the disease. No doubt this disease is present in other islands of the West Indies, but on account of the limited extent of the banana industry in them it has not yet been reported. In Central America the disease is wide-spread, being especially virulent in Costa Rica; it has also been reported from Mexico. It first attracted wide attention in Panama early in the present century, and in Surinam the disease is notorious for its destructive nature and wide-spread occurrence. Evidence that it exists in India is fairly conclusive, and it is probably present in Australia and the Dutch East Indies. That it was introduced into the Hawaiian Islands from Costa Rica seems certain, since the outbreak of the disease there quickly followed the first importation of Gros Michel banana plants from Costa Rica.

The promiscuous shipping of plants from a common source into the various countries of Central and South America, and the West Indies, has been probably responsible for the wide distribution of the disease in tropical America. The intensive cultivation of bananas on the same land year in and year out, for export purposes chiefly, has resulted in the disease becoming steadily worse in districts where this is practised. Where bananas are grown in a desultory way for home consumption, the disease may be present but is never serious.

As early as 1910 this disease was regarded as one of the most important fungus diseases of cultivated plants in the American tropics. The extent of the industry which it threatened may be gauged from the estimate that American consumers pay at least $200,000,000 annually for bananas, and although the late war has somewhat checked the exportation of this fruit to European countries, it is considered that the consumption of bananas in those countries will soon rival that of the United States. It must also be remembered that the home consumption of bananas in some tropical American countries is of more importance than the export trade. For instance, the city of San Juan, Porto Rico, alone consumes about 3,000,000 dozen bananas per annum, and for hundreds of thousands of Porto Ricans it is one of the main articles of diet.

When such an industry is threatened by a widely distributed and apparently infectious disease, it can be well understood that banana planters have reason to be alarmed. During the past ten years the money loss in the cultivation of bananas in Panama and Costa Rica has been estimated to have been many millions of dollars.

In Surinam a serious effort was made in the year 1906 to establish an export industry in bananas. By 1910 every field under the Gros Michel variety was affected, and many planters were ruined.

Last year the disease was almost universally prevalent in the western part of Cuba in plants of a local variety which is most esteemed in the Havana market, but is not exported.

Jamaica has not suffered any great loss from this disease, due largely to the vigilance of the Agricultural Department, the Government having established a quarantine on all affected areas in the island.

Apart from pecuniary losses as a result of this disease, owing to loss of trade, there are three other classes of losses which may briefly be mentioned: (1) injury to the fruit, (2) destruction of immature plants, and (3) depreciation of the value of the land. With regard to thefirst, if a bunch of fruit is produced, it is apt to be small, and is always rejected by the inspectors. With regard to the second, immature plants die in enormous numbers before any fruit is produced, and only rarely is a marketable bunch obtained from an infected field. The third type of loss, namely the depreciation in value of the land, is due to the fact that the causal organism of the disease may remain for long periods in the soil, and finally increase to such an extent that bananas can no longer be grown.

The description of the disease, and suggestions made for its control and eradication, will be reproduced in following numbers of this Journal.

The Department of Scientific and Industrial Research issues from time to time a list of research associations which have been approved by the Department as complying with the conditions laid down in the Government scheme for the encouragement of industrial research. The following associations which are concerned with West Indian products have received licenses from the Board of Trade: British Cotton Industry Research Association, Manchester; British Empire Sugar Research Association, London, W.; and British Cocoa, Chocolate, Sugar Confectionery and Jam Trades Research Association, London, E.C., 4.

THE QUESTION OF POLICY IN THE SELECTION OF CANE VARIETIES.

In the *International Sugar Journal*, January 1920, there is a short review of a paper by F. S. Earle on the varieties of sugar-cane in Porto Rico. The review is signed C.A.B., the well-known initials of Dr. Barber. It is of such general interest to sugar-cane planters and sugar manufacturers, that it is reproduced below :—

In a recent paper, F. S. Earle, Agronomist of the Insular Experiment Station in Porto Rico, estimates that there may be considerably over 500 cane varieties grown in that island ; and, before proceeding to describe some of the most important of these, he submits some thoughtful remarks on the policy of planting—which class of cane should be aimed at under each set of local conditions. Thus the handling of low-grade canes requires abundant labour, for the yields must be large to counter the poorness of the juice : they are more fibrous, and harder to grind, and the poorer juice requires a greater amount of concentration. The class of cane to be planted, therefore, depends to a large extent on the amount and character of the labour, and capacity and strength of the mills. In Porto Rico there is abundant labour, and the mill capacity is in excess of the supply of canes. A great yield of canes to the acre is therefore to be sought. As has frequently been observed elsewhere, the sucrose percentage in the juice of canes often varies inversely as the vigour of growth, and the chances are that any variety showing excessive luxuriance will be found to have poor juice, and the converse is often true.

On the other hand, where labour is scarce and milling capacity low, it pays better to grow canes with less tonnage but richer juice, and the object is to obtain the greatest possible amount of sugar per ton of cane. The policy to be adopted becomes more complicated where cane-farming is in vogue. The cane farmer wishes to produce a great tonnage of canes, while those in charge of the mills desire a juice as rich as possible, and a conflict of interests is the result. Adjustment is needed; and it is suggested that the best arrangement is that payment should be made for the actual sugar in the canes brought in.

In the formulation of a successful policy of selection of cane varieties, a thorough knowledge is required of those planted, and their respective yield in different classes of soil, and this knowledge can only be obtained by the keeping of accurate records over a great number of years. 'We need to know not only how each variety yields under ordinary plantation treatment on each of the principal soil areas, but how it responds to special treatment—better cultivation, more fertilizer and irrigation. Another most important point to determine is that of comparative resistance and susceptibility to the various diseases and insect pests that attack cane. The failure of kinds commonly cultivated when attacked by some of these many enemies and the search for kinds having greater resistance, has been the leading cause for the production of this multitude of new varieties.' The work of Bovell in Barbados, and Harrison in Demerara is referred to, especially the laborious and careful testing of the many kinds they have produced, and the recording of the results obtained with each under varying local soil and cultural conditions. The author might have spoken of the marvellous work done in this direction for many years in Java, unfortunately obscured by being described in a little-known language, but which has been largely responsible for placing the cane industry of that island in its present unique position. But though this work has been of inestimable benefit to the industry in the localities mentioned, it cannot unfortunately be made use of in other places, excepting as a guide to the class of work that is required. In the introduction of cane varieties from other countries, too much importance is attached to the published accounts of phenomenal yields of special canes, and heaven and earth are moved to obtain cuttings of these at the earliest possible moment, without any knowledge of the peculiar conditions of the country where the results were obtained. Before such work is undertaken, a careful comparative study should be made of the climate, soil, rainfall and irrigation possibilities, labour and mill capacity, and the success or otherwise of the varieties already established under varying conditions. Then only will it be possible to formulate a successful policy as to the class of cane varieties to be aimed at.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets for the month of December :—

The month of December began with a fair amount of business in drugs and spices, so far as bulk was concerned, but always accompanied with advanced prices, although lime oil and lime juice have been cheaper, as will be seen later on.

GINGER.

This article was in steady demand at auction on the 11th of the month, African fetching 74*s.* and Japanese 52*s.* 6*d.* At auction on the 18th of the month the quotations were as follows: Japanese 55*s.* to 60*s.* per cwt., and Sierra Leone 65*s*, while common to good common Jamaica were quoted at 82*s.* 5*d.* to 90*s.*, and medium to good 95*s.* to 100*s.*

NUTMEGS AND PIMENTO.

In the early part of the month nutmegs were reported 'firm,' and until further consignments of West Indian are available no decided alteration is looked for. At auction on the 18th of the month West Indian nutmegs were reported scarce, while Singapore were easier, and more freely offered. At the last auction on the 23rd they were still in very quiet demand, at easier prices for Singapore and Penang. Pimento has been firm throughout the month at from $5\frac{3}{4}d.$ to 6*d.* At auction on the 11th of the month 1,151 bags were bought in at 6*d.*

SARSAPARILLA.

Of this drug there has been a large number of shipments of Mexican to New York, but a question has arisen as to the genuine character of the drug, in consequence of which the dealings in it have been very uncertain and complicated.

KOLA, LIME JUICE, LIME OIL, AND CITRIC ACID.

At auction on December 4, kola was in good supply and fair demand, $7\frac{1}{2}d.$ per lb. being the price asked and paid for fair bright Jamaica halves, and $6\frac{1}{2}d.$ for African quarters. It was stated that from January 1, 1920, a duty of 4*s.* 8*d.* per cwt. would be placed on kola exported from Sierra Leone. At auction on the 11th of the month it was stated that in consequence of the accumulation of supplies of lime juice, prices were declining, and fair raw West Indian could be easily obtained at 2*s.* 3*d.* per gallon, West Indian distilled oil of lime was easily obtained throughout the month at 6*s.* per lb., and hand-pressed at 10*s.* The demand for citric acid has been slow at from 4*s.* 1*d.* to 4*s.* 2*d.* per lb.

MARKET REPORTS.

London.—The West India Committee Circular, January 8.

Balata—Venezuelan Block, no quotations ; West Indian Sheet, No quotations.
Beeswax—No quotations.
Cacao—Trinidad, 130*s*. Grenada, 127*s*. Jamaica, St. Lucia, St. Vincent, and Dominica, 115*s*. to 127*s*.
Copra—No quotations
Honey—No quotations
Lime Juice—Raw, 2*s*. 6*d*. ; Concentrated, no quotations.
Pimento—No quotations
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T S. Garraway & Co., February 17.

Arrowroot—$9·00 per 100 lb. duty paid.
Cacao—No recent sales
Coco-nuts—$45·00 husked nuts.
Hay—$5·50 per 100 lb.
Onions—Lottings at $20·00.
Peas, Split—No quotations; Canada, Market bare.
Potatoes—Market bare.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, January 20.

Bay Oil—23*s*. 6*d*.
Lime Oil—4*s*. 3*d*. for West Indian distilled, and 10*s*. for hand-pressed.
Orange Oil—West Indian, 25*s*.

Trinidad.—Messrs. Gordon. Grant & Co., February 4.

Cacao—Venezuelan, $26·50 ; Trinidad, $25·75. to $26·00
Coco-nut Oil—$2·10 per gallon.
Coffee—Venezuelan, 24c. per lb.
Copra—11½c. per lb.
Dhal—$12·00 to $13·00
Onions—$10·00 per 100 lb.
Peas, Split—$12·00 per bag.
Potatoes—English, $6·00 per 100 lb.
Rice—Yellow, $12·00; to $13·00 White, $12·00 per bag.
Sugar—No sales made.

New York.—Messrs. Huth, Gillespie & Co., Inc. February 3.

Cacao—Caracas, 24c. Grenada, 20c. Trinidad, 21c. ; Jamaica, 18c. to 19c.
Coco-nuts—Jamaica selects, $65·00 per M; Trinidad $42·00 per M; culls, Jamaica, $65·00 ; Trinidad $42·00 per M.
Coffee—Jamaica, 19c. to 25c. per lb.
Ginger—21c. to 24c. per lb.
Goat Skins—Jamaica $1·60; Antigua and Barbados; $1·55 to $1·60 ; St. Thomas and St. Kitts, $1·55
Grape Fruit—Jamaica, $3·00 to $4·50.
Limes—8c. to 8½c.
Mace—40c. to 42c.
Nutmegs—27c. to 28c.
Oranges—$4·00 to $4·50.
Pimento—9¾c. to 10c. per lb.
Sugar—Centrifugals, 96°, 11c. c. & f. ; Muscovados, 89°, 11c. Molasses, 89°, 11c.

FOR SALE

ONE LOCOMOTIVE BOILER.

This Boiler has been recently retubed and thoroughly tested, being in good condition.

Inspection can be made at our premises in White Park Road, Bridgetown, Barbados.

For Further Particulars apply to

The Barbados Co-operative Cotton Factory, Ltd.

WHITE PARK.
October 9, 1919.

AGENTS FOR PUBLICATIONS OF THE IMPERIAL DEPARTMENT.

London: Messrs. Dulau & Co., Ltd., 34-36, Margaret Street, Cavendish Square, W.
West India Committee, 15, Seething Lane.
Barbados : Advocate Co., Ltd., Broad Street, Bridgetown.
Jamaica : The Educational Supply Company, 16, King Street, Kingston.
British Guiana : The Argosy Co., Ltd., Georgetown.
Trinidad: Messrs. Muir-Marshall & Co., Port-of-Spain.
Tobago: Mr. C. L. Plagemann, Scarborough.
Bahamas: Mr. H. G. Christie, Board of Agriculture, Nassau
Grenada: Messrs. Thos. Lawlor & Co., St. George.
St. Vincent: Mr. J. D. Bonadie, 'Times' Office.
St. Lucia: Mr. R. W. Niles, Botanic Station.
Dominica: Mr. J. R. H. Bridgewater, Roseau.
Montserrat: Mr. W. Robson, Botanic Station.
Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre.
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 801, Yonge Street, Toronto

AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

VOL. XIX. No. 466. BARBADOS, MARCH 6, 1920. PRICE 1d.

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A Tropical Agricultural College in the British West Indies.

I

REFERENCE has already been made in previous numbers of this Journal to the movement which is at present on foot for the establishment of a Tropical Agricultural College in the British West Indies. The history of the movement is briefly as follows.

For many years there has been a wide-spread opinion that it would be for the permanent advantage of these islands, whose prosperity is almost entirely dependent upon agriculture, that an Agricultural College should be established somewhere in them, in order that definite and continuous expert instruction may be given in subjects relating to tropical agriculture. Some eight or ten years ago, opinions were expressed that it was desirable that such colleges should be founded both in the Eastern and the Western Tropics. A little more than a year ago the movement in favour of establishing such a college in the West Indies was again seriously started. Resolutions were passed by the Agricultural Societies of Trinidad, Antigua, St. Kitts, and Jamaica, bringing the question to the notice of the Secretary of State for the Colonies, and asking him to take steps which might render possible the establishment of the desired college.

In consequence of these representations, Lord Milner, the present Secretary of State, appointed a Committee in August last to consider the question as to the desirability of establishing a Tropical Agricultural College in the British West Indies, and to advise generally on matters relating thereto.

The Committee so appointed, as is evident from the list of names given in another column, is a very strong one, consisting of men of distinction in the academic world, as well as of others widely known in connexion with West Indian agriculture and commerce. Such a Committee was certain to give careful and wise consideration to the many and various aspects of the problem involved.

The Committee presented their Report in November last, and the Secretary of State has recently forwarded this for the consideration of the Governments of all the West Indian colonies, together with a despatch in which Colonel Amery, on behalf of Lord Milner, commends the general recommendationsof the Committee to favourable considera-

tion, and asks that the fullest publicity may be given to their Report and to the Secretary of State's views concerning it, that it may be ascertained to what extent support will be given to the establishment of such a college.

The recommendations of the Committee are briefly as follows :—

In the first place the Committee expresses the opinion, without hesitation, that steps should be taken at an early date to found a Tropical Agricultural College in the West Indies.

The following reasons are given for this opinion:—

(i) The need for such an institution has been for some years increasingly apparent. In order that British tropical colonies may be placed in a position to compete successfully with foreign countries in the production and marketing of the staples of the tropics, it is of paramount importance that their young men should be afforded instruction in the principles of agriculture, and in the preparation for market of tropical products of every kind, many of which constitute the raw materials employed in the manufactures of the Mother Country.

(2) The need which exists of making full provision for the prosecution of research and for the training of scientific investigators in matters pertaining to tropical agriculture amid suitable surroundings, and for creating a body of British expert agriculturists well versed in the knowledge of the cultivation of the land in the tropics, and of scientific advisers possessing an intimate knowledge of the means of combating pests and diseases, the control of which is essential to the successful development of the tropics.

(3) The fact that the establishment of a Tropical Agricultural College in the West Indies is a matter of Imperial concern. Such a college would be of no less importance to the Mother Country than to the colonies immediately concerned, having regard to the present necessity of developing production throughout the Empire to the utmost extent.

The second point dealt with by the Committee was the situation of the college, and the following is the conclusion reached. After carefully considering the matter in all its aspects, and with special reference to the geographical position and grouping of the various West Indian islands and British Guiana, and to the general desire that the college should be closely associated with the Imperial Department of Agriculture, the Committee recommends that the Tropical Agricultural College be established in Trinidad, provided that the Government of Trinidad and Tobago is prepared to afford it adequate support and every reasonable facility.

In arriving at this decision the Committee were influenced by the fact that Trinidad possesses a wide variety of industries, and is easy of access by steamer communication to residents in the neighbouring islands and British Guiana.

The claims of Barbados were also closely considered, but could not be entertained, owing to the smaller range of that island's products.

The Committee recognizes that the claims of of Jamaica have great weight, this colony having a population approximating to that of the rest of the West Indian islands, and a still wider variety of industries than that possessed by Trinidad. They felt, however, that difficulties of intercolonial transit would form a serious obstacle to the transfer of the Imperial Department of Agriculture to Jamaica if, as is so much to be desired, the islands of the Lesser Antilles are still to derive immediate advantage from the work of that useful body.

A further meeting of the Committee was held to consider a telegram received from Jamaica, to the effect that the financial majority of the elected members of the Legislative Council of that colony agreed to support an initial grant of £50,000, and a grant of £5,000 annually, towards the Agricultural College, if Jamaica be made the headquarters of the Imperial Department of Agriculture. The Committee, nevertheless, adhered to the recommendations above stated, considering, however, that the possibility of establishing the college in Jamaica might be again considered.

The incorporation and constitution of the proposed college are the next points dealt with in the report. These are important matters, for on them in reality the future of the college largely depends.

Whilst advocating that it should be the ultimate object of the governing body of the Tropical Agricultural College to petition His Majesty the King for a grant of a Royal Charter of Incorporation, the Committee recommends, that, at the outset, the college be incorporated in the United Kingdom as a company limited by guarantee. This is the procedure which is now being followed by various Scientific Research Associations which are being established in the United Kingdom. Such a course will give the college a definite status, and confer certain advantages.

With regard to the constitution of the proposed college, the Committee recommends that the affairs of the college be administered by a Governing Body

composed of Trustees and Governors whose meetings shall ordinarily be held in London, but they shall appoint from their body an Executive Committee, whose meetings shall be held in the colony in which the college is situated.

This arrangement appears to be an admirable one: it creates a body of men who, meeting in England will be likely to take the broadest views concerning the work of the college and its management: they will be in close touch with those having interests in tropical agricultural affairs, with scientific and educational authorities, and with the Government. This should ensure that the college is free from the reproach of insularity or narrowness, while the existence on the spot of the Executive Committee should ensure that due weight is given to all local requirements, and permit of prompt, rapid action in essential matters, without delay arising from the necessity of referring matters of detail to England for the consideration of the Governing Body.

It is proposed that the Governing Body shall be nominated by those interested in the work and welfare of the college. It is suggested that two members shall be nominated by the Secretary of State for the Colonies, and one member by the Academic Board of the college; members are also to be nominated by the several Colonies participating in the College. It is anticipated that there will be six such members, one each nominated by Barbados, British Guiana, Jamaica, Trinidad and Tobago, the Leeward Islands, and the Windward Islands.

Three members are recommended to be nominated by Academic Institutions in the United Kingdom, a matter which the Committee regards as of the highest importance. The suggestion is made that the various Academic Institutions shall be placed on a roster, and invited to nominate representatives in such order as may be determined, it is recommended that in the first instance the University of Cambridge, the University of Glasgow, and the Imperial College of Science and Technology of London shall be invited to nominate each, one representative.

A group of members is to be nominated by contributing industries; it is thought that the number may vary, but, in the first instance, it is considered possible that the number may be five, namely, one each representing the cacao, cotton, coco-nut, fruit-growing, and sugar industries, respectively.

It is recommended that there shall be two *ex officio* members, namely, the Senior Financial Officer of the colony in which the college is situated, and the Principal of the College.

There are also to be four co-opted members, two of whom are to be selected in respect of their ability to serve also as members of the Financial Committee of the Governing Body, the other two in respect to their ability to serve as members of the Executive Committee.

As thus constituted, the number of the Governing Body would be twenty-three, and although this number may seem large, it is believed that it will not be unwieldy, particularly in view of the fact that several members will constitute the Executive Committee, which will sit in the colony in which the college is situated.

The latter part of the Report, which deals with the questions of the teaching staff of the college and the proposed financial arrangements, will be dealt with in a subsequent issue.

THE AGRICULTURAL COLLEGE COMMITTEE.

The Committee comprises the following members:—

Dr. A. E. Shipley, LL.D., Sc.D., F.R.S., Master of Christ's College, and Deputy Vice-Chancellor, *Chairman*.

Lieut.-Colonel Sir David Prain, C.M.G., C.I.E., F.R.S, Director of the Royal Botanic Gardens, Kew, *Deputy Chairman*.

Sir Norman Lamont, Bart., Member of the Legislative Council of Trinidad and Tobago.

The Hon. Gideon Murray, M.P., late Administrator of St. Lucia.

Sir Owen Philipps, G.C.M.G., M.P.

Sir Henry Frank Heath, K.C.B., Secretary to the Department of Scientific and Industrial Research.

Sir Francis Watts, K.C.M.G., D.Sc., Imperial Commissioner of Agriculture for the West Indies.

Sir Edward Davson, President of the Associated Chambers of Commerce of the West Indies.

Dr. C. A. Barber, C.I.E., Sc.D., F.L.S., Sugar-cane Expert for India.

Mr. Robert Rutherford, Chairman of the West India Committee.

Mr. Henry Alexander Trotter, Deputy Chairman of the West India Committee.

Mr. Elliot Arthur De Pass, Chairman of the Jamaica Standing Committee of the West India Committee.

Dr. J. B. Farmer, M.A., D.Sc., F.R.S., Professor of Botany, Imperial College of Science and Technology.

Captain A. W. Hill, M.A., Sc.D., F.L.S., Assistant Director of the Royal Botanic Gardens, Kew.

Mr. W. H. Himbury, General Manager of the British Cotton Growing Association.

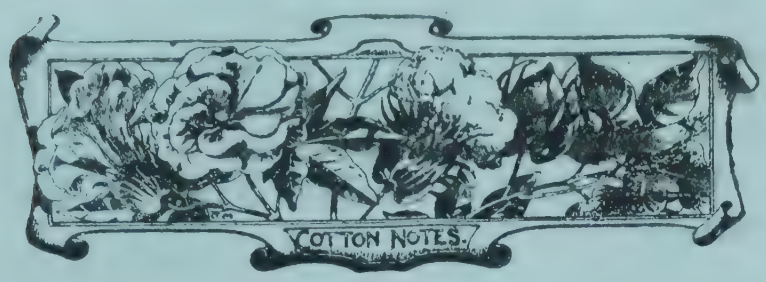
Mr. J. W McConnel, Member of the Empire Cotton Growing Committee, Board of Trade.

Mr. G. Moody Stuart, West Indian Estates' Proprietor).

Mr. Algernon E. Aspinall, C.M.G., B.A., *Hon. Secretary*. Secretary of the West India Committee.

Sir Henry Frank Heath, K.C.B., was unable to attend any of the meetings, and was represented by Mr. A. Abbott.

Dr. C. A. Barber, C.I.E., Sc.D., F.L.S., was co opted a member of the Committee.



COTTON NOTES.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended January 24, 1920, is as follows :—

ISLANDS. Since our last circular report of the 10th inst. there has been a good demand for Planters' crop lots of Extra Fine, at prices ranging from $1·00 to $1·40, the buying being on account of French spinners, resulting in the above sales. About one-half of the crop lots has been sold, and we do not think this demand has been satisfied.

The supply of odd bags classing Fine to Fully Fine is much reduced, and the holders are inclined to be firmer in their views.

We quote, viz:—

Fine to Fully Fine @ 85c., f.o.b. and freight.

GEORGIAS AND FLORIDAS. During the past fortnight there has been a better demand, principally for the lower grades, of which the sales principally consist, the buying being for the Northern Mills. The offerings of the better grades are small and are firmly held, with holders asking an advance. Some sales have been made at higher prices.

We quote, viz :—

Average Extra Choice, @ 83c. to 84c., f.o.b and freight.

The exports from Savannah since January 10 have been, to Northern Mills 1,166 bales, Southern Mills 25 bales, and from Jacksonville to the Northern Mills 135 bales.

The United States Census Bureau reports the amount of Sea Island cotton ginned to January 16, as follows :—

South Carolina	3,248 bales	making a total of	6,828 bales
Georgia	656 bales		
Florida	2,924 bales		
against last year,	41,088 bales	Total crop	44,380 bales.
„ 1918	88,747 bales	„ „	88,174 bales.
„ 1917	115,463 bales	„ „	113,109 bales.
„ 1916	90,736 bales	„ „	85,278 bales.

This report apparently points to a total crop of not much over 7,000 bales.

THE EMPIRE COTTON GROWING COMMITTEE

This Committee has recently issued to the Board of Trade a report which contains much matter of interest to all countries within the limits of the British Empire where cotton is or can be cultivated.

The Committee consists of twenty-one members, including representatives of India, Australia, South Africa, and Egypt, as well as of the Foreign Office, the Colonial Office, and the Board of Trade, together with nominees of the British Cotton Growing Association, the Imperial Institute, and the principal Associations of Employers and Employed in the industry

It was appointed in July 1917 to investigate the best means of developing the growing of cotton within the Empire, and to advise the Government as to the necessary measures to be taken for this purpose.

In the prefatory remarks introducing the report, the Committee draws attention to the original memorandum which was submitted to the Prime Minister in July 1917, in which the following propositions were formulated :—

A. That the present situation as to the supply of cotton is most serious, and requires the immediate attention of His Majesty's Government.

B. That it is essential for the future prosperity of Great Britain and for the welfare of the Colonies that cotton growing should be developed as rapidly as possible in all suitable parts of the Empire.

It was also pointed out that the British Empire was especialy affected by the shortage of cotton in the world, seeing that in many respects the cotton industry was the most important British industry. It was further pointed out that the British cotton industry was obtaining four-fifths of its supplies of the raw material from the United States, which was a dangerous condition of affairs, especially considering that the United States were year by year requiring for their own consumption an increasing proportion of their own crop. It was also pointed out that experience showed that in many parts of the Empire, the production of cotton is, or could be, made very profitable to the country growing it; Egypt, the Sudan, Uganda, and some of the West Indian islands, such as St. Vincent and Montserrat, were named as instances. Finally, it was believed to be possible to grow within the Empire the quantities and qualities of cotton that the industry requires.

The report goes on to remark that all the investigations made by the Committee tend to confirm the above statements.

There is no doubt about the shortage of cotton, nor as to its importance to Great Britain and the British Empire. Since July 1917, the situation has become decidedly worse. Owing in part to the necessity for growing more foodstuffs to meet the needs of the war, the cotton crops in the United States, in Egypt, and in India have been curtailed. Moreover, the seasons have been unfavourable, and the present season is giving rise to fears that the crops in the United States and in Egypt will again be deficient. The advent of peace has in no way improved the situation. There is evidence of a world shortage of cotton goods, and there is no prospect whatever of there being a full supply of cotton for some years to come. Prices of cotton are already at levels far in excess of anything recorded since the cotton famine in the sixties of the last century.

The report is divided into two parts : Part 1 deals with the progress made by the Committee in the study of the Empire's resources for cotton growing, and of the general plans and proposals suggested by it for their development. Part 2 contains a detailed survey of the position, both present and prospective, in the various territories which are considered suitable for the cultivation of cotton.

It may be remarked that, in the appointment of the Committee, it was understood that it should not merely present a report, and then cease to exist, but, on the contrary, that it should become a Standing Committee in connexion with cotton growing within the Empire. Accordingly a series of sub-committees has been formed dealing with special departments of the subject. These sub-committees deal respectively with (1) Finance ; (2) Commerce ; (3) Research and Education ; (4) Information (including both its collection and dissemination) ; (5) India ; (6) Egypt and the Sudan (7) The Dominions, Colonies, and Protectorates.

The problem before the Committee is the adequate development of the Empire's resources for the production of cotton. The report considers that its solution will depend on the proper handling of three main questions. These are: (1) the acquisition of necessary knowledge, and the supply of men to apply their knowledge; (2) the establishment of efficient arrangements for (a) controlling the growing of cotton crops, and (b) marketing the crops when grown, so as to secure the best possible results for the growers; (3) the provision of the necessary funds.

The suggestions made by the Committee as to the best ways of dealing with these questions will be the subject of other articles in future issues of this Journal.

COTTON EXPORTS FROM THE WEST INDIES.

The following figures show the quantity and estimated value of Sea Island cotton exported from the West Indies for the season, October 1, 1918 to September 30, 1919 :—

Colony.	Quantity in lb.	Estimated Value, £.
Grenada	1,595	240
St. Vincent	431,586	67,555
Barbados	114,444	18,318
Montserrat	595,734*	92,243
Antigua	158,750	23,808
St. Kitts	442,681	66,402
Nevis	307,212	46,082
Anguilla	47,869	7,181
Virgin Islands	40,260	4,538
Total	2,140,131 lb.	£326,367

Besides the above, Grenada exported 326,368 lb. Marie Galante cotton, valued at £12,768, and St. Vincent 38,751 lb., valued at £3,230.

There were also exported from Barbados 6,413 lb. of linters, and from St. Vincent 3,690 lb., of the estimated values of £171 and £185, respectively.

The Virgin Islands also shipped 4,260½ lb. of native cotton, valued at £316.

*The cotton exported from Montserrat includes stained lint, valued at 1*s.* 6*d.* per lb.

THE ABSORPTION OF PHOSPHORIC ACID BY SOILS.

The first instalment of an article which forms the third in a series of papers on fertilizers prepared by J. A. Brock, D.Sc., for *Facts About Sugar*, and which appears in the number of that journal for January 17, 1920, deals with the subject of phosphoric acid as a plant food. A brief summary of this should be of value to readers of the *Agricultural News*. The writer begins by stating the well-known fact, that next to nitrogen, phosphoric acid (P_2O_5) is the most important of all plant foods applied to land. Of the mineral constituents of soil, it is also the most important. Its action in the soil is next considered, and then its absorption by soils.

The power of various soils to absorb soluble phosphoric acid is brought out in the following table prepared by Voelcker, which shows the percentages of the total phosphoric acid supplied, which were removed from solution by various soils after remaining in contact for specified times, the ratio between soil and phosphoric acid being about 1,000 to 1 :—

	Percentage phosphoric acid absorbed after 1 day	8 days	26 days.
Red loam	60	78	95
Chalky soil	89	99	100
Stiff clay	51	62	86
Stiff subsoil	48	69	74
Light sandy soil	53	59	73

The humus content of the soil also plays an important part in rendering phosphoric acid valuable. It has been found, for example, that in the presence of large quantities of organic matter undergoing decomposition, phosphoric acid is made valuable. On the other hand, if the humus content of the soil is low, there is often a corresponding reduction in the amount of available phosphoric acid. It is not to be understood, however, that all soils rich in humus are necessarily rich in phosphoric acid.

The writer calls attention at this point to the fact that it is estimated that, after sugar beets have been harvested, there remains in the soil approximately 1 ton per acre of rootlets which were broken off by the lifter from the beet proper. The fact that these roots, during decomposition, render phosphoric acid available, is a point that should not be overlooked.

Pure phosphoric acid (P_2O_5) is never used directly as a plant food, but only when it is in combination with other substances, principally lime, iron and alumina. The compounds formed when these substances go into combination with phosphoric acid are known as phosphate of lime, phosphate of iron, or phosphate of alumina. It is from these compounds principally that the phosphoric acid contained in commercial fertilizers is derived The phosphates of lime are used principally in the manufacture of commercial fertilizer.

One of the principal substances containing phosphate of lime is animal bone. The amount of this compound present in bone varies with the age of the animal. It also varies with the form of bone used. In other words, there are different forms in which bone is used as a manure.

Raw bone, as the term implies, is bone that has not lost any of its original constituents. In this condition it contains approximately 22 per cent. of phosphoric acid in the form of tricalcic phosphate. In other words, 1 part of phosphoric acid is combined with 3 parts of lime in each molecule.

Ground bone has the same composition as raw bone, the physical condition alone being changed. Bone in this form acts upon the soil more quickly than does the raw unground bone.

Steamed bone and boiled bone have been found to be more valuable than either raw or ground bone, owing to the fact that the fat has been removed, thus increasing the proportionate amount of phosphoric acid present. Steamed bone and boiled bone contain, on an average, from 20 to 30 per cent. of phosphoric acid in the form of tricalcic phosphate.

Bone tankage contains from 7 to 19 per cent. of phosphoric acid in the form of tricalcic phosphate. Bone-ash contains from 20 to 36 per cent. of phosphoric acid.

It will be noted that the phosphoric acid in bone is present in the form of tricalcic phosphate. This is an insoluble form, and therefore should be used for permanent benefit to the soil rather than as an immediate source of phosphoric acid.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. VINCENT. During the month of January general routine work was performed in the Experiment Station and Botanic Garden. Plant distribution included 11 miscellaneous plants and 50lb. of Bengal beans. Mr. Jackson states that in the Leeward District of the island planters have commenced to pull up cotton stalks. On lands in good heart, fair second pickings are being made. The cane crop is giving fair returns. Last year 170,842 gallons of syrup and molasses were exported as against 79,845 gallons in 1918 ; this is more than 100 per cent. increase. A further increase, he thinks, may be looked for in 1921. During the month the Cotton Ginnery received for ginning 251,934 lb of seed-cotton. The amount of cotton purchased was 69,747 lb., and the quantity of lint ginned was 64,527 lb. Pigeon peas were purchased and stored for the use of Government institutions. The attack of cotton stainers is not increasing to any great extent. The rainfall registered at the Experiment Station was 7·05 inches; at the Botanic Garden the record was 7·09 inches.

ST. LUCIA. Plant distribution during the month of January comprised 2 grafted mangoes, 2 budded oranges, 124 ornamental and 124 shade plants. Work in the Botanic Garden and Experiment Stations was of a general routine nature. Regarding staple crops Mr. Brooks states that the cacao and lime crops are slackening, and reaping operations with sugar were general. Considerable extension was taking place in cane cultivation. Mr. Niles, Agricultural Officer, has been appointed Instructor in connexion with the school garden in course of formation by the St. Mary's College for the teaching of Practical Agriculture. The rainfall registered at the Botanic Garden, Castries, during the month totalled 6·11 inches; at the Agricultural and Botanic Station, Choiseul, the precipitation was 5·78 inches.

MONTSERRAT. Plant distribution during the month of January comprised 25 papaw plants, 19 packets of various beans, and 115 rose cuttings. The experiment plot of yams was reaped, showing an increase of 100 per cent. in yield from the staked vines over the unstaked. An interesting experiment is being inaugurated, consisting of seven progeny rows from forty selected plants.

The principal work on estates in connexion with cotton, Mr. Robson states, was the destruction of old plants and the preparation of the land for the next crop. The activity, particularly among small cultivators, is greater than ever, and the area in cotton again promises to be very large. About the middle of the month 1,006 bales netting 396,000 lb. of lint cotton of the 1919-20 crop were shipped. As practically one-third of the crop remains behind, it is anticipated that the total crop will exceed 500,000 lb. lint. A proposal is on foot to create the post of Cotton Inspector in connexion with the Cotton Ordinances in force in the Presidency. Sweet potatoes are fairly plentiful. The weather during the month was showery, the rainfall as recorded at Grove Station being 5·21 inches.

AGRICULTURE IN BARBADOS.

The weather for February in practically all the low-lying districts of the island has been dry, while the hilly parishes have registered light showers almost daily.

The absence of rain and the high winds which have been almost continuous for the past two months are causing the sea-boards to turn quite brown. The St Philip's coast particularly has browned considerably. The burning winds have even blistered, and in some instances laid low the peasants' eschalots in the neighbourhood of the Ragged Point light house. We mention this to show how thoroughly the high sea-breezes do their scorching work in these localities.

Since our last report, several estates, principally in the black soil, have started crop ; but except at Warrens in St. Michael's parish, the density is very low ; in some instances 8°, in others, under this figure. At Warrens the density is 10°. Planters are trying to postpone reaping to as late a date as possible.

The B.H.10 (12) is likely to give the premier yield this year. Its richness in saccharose will be all in its favour, and in the red soil, both as a plant cane and as a ratooner, it has developed remarkably well.

Where the factories have started there is a rush by the peasant proprietors to get their plots reaped. Their canes are by no means ripe, and in St. Michael's parish they are being paid at the rate of $19 per ton where they cart their canes themselves to the factory. At this date two years ago $7·30 per ton was the price paid for the best canes.

As far as we can gather, about three-fourths of the crop of the island has been sold, most of it having been disposed of at much less than the top price: $7·25 was such a dazzling figure that planters caught at it in August and September last year.

The crop is looking well and is growing rapidly. The first fields planted are bunching well and, where the crops have been started in the black soil, the most forward fields are being trashed. The earlier the better, as evaporation will be retarded and the young plants will be greatly assisted during the dry season which has apparently begun. There is still some supplying to be done as also some manuring, draining and forking, but in general, the fields are looking well, and planters will be spared the experience through which they passed at this time last year in connexion with the establishing of the crop now to be reaped. Some planters, owing to shortage of farmyard manure, are having to complete the fertilizing of their young crop with a liberal application of sheep manure. (The Barbados *Agricultural Reporter*, February 21, 1920).

CHEAPER MULE FEEDING.

An article contributed to *Facts About Sugar*, for January 10, 1920, by J. A. Simms and Stanley F. Morse, on the cost of mule feeding in Louisiana, appears of sufficient general application to these West Indian colonies, to justify reference in this Journal, the object being to show how an important item of plantation costs can be reduced.

It is stated that 15 to 20 per cent. of the cost of the cane crop in Louisiana is chargeable to mule feed, but that this cost can in many cases be reduced with little or no expenditure of extra time or care. The feed should at all times keep the mules in first class physical condition, give sufficient strength for the work on hand, and be as cheap as possible. To serve these purposes, the necessary amount and no more, of protein, carbohydrates, fats, and ash should be contained in the ration.

A common fault of rations at present used, is an insufficiency of protein, diminishing the digestibility of the feed, with the result that more feed is required ; and lowering the vitality and vigour of the animal, thus reducing the amount of work which can be performed daily. A too common ration

is made up of corn, molasses and grass hay, which furnish only one-third to one-half of the needed protein.

Many planters consider oats and corn of equal feeding value, pound for pound, when as a matter of fact oats furnish 24 per cent. less energy than corn. If, however, the ration is exceedingly poor in protein, a pound of oats may be equal to a pound of corn, because oats contain more protein, and a much more valuable protein than corn. In this case 24 per cent. of the value of the corn is wasted, but could be saved by adding the proper amount of a feed high in protein, such as cotton seed meal for instance. Corn, in proportion to its feeding value, is usually much cheaper than oats, so that it is rarely economical to feed any considerable quantity f oats unless grown on a plantation. which is not the practice in these West Indian colonies. A corn-fed mule, it is observed, will do just as much and just as good work as the oat-fed one, provided the ration is properly balanced.

When rations are properly balanced, and good hays are fed—Para grass, sour grass, Guinea, and crab grass for instance—both the cost per pound and the amount of concentrates can usually be reduced, the saving averaging, probably from $25 to $75 per mule per year. Feeds should always be purchased on the basis of their content of digestible protein or carbohydrates. Less concentrates should be fed to mules doing light work than to those doing heavy work. Hay and straw, and a few pounds of concentrates are entirely sufficient for idle mules. As should be well known, turning mules into pasture will reduce the amount of feed to be purchased, improve the digestion and physical condition of the mules, and allow them to rest more comfortably, particularly where night pasturing is practicable. During long periods of idleness, it will reduce by more than 50 per cent. the amount of feed needed, and will give the mules sufficient exercise to keep them in good condition.

The article concludes with a table of sample rations, which might pofitably be consulted.

SECONDARY EDUCATION IN ST. KITTS

Mr. W. H. Mitchell, the Head-master of the St. Kitts Grammar School, has recently supplied the Imperial Commissioner of Agriculture with some observations on the history, aims, and work of that institution, which contain much interesting matter. The following remarks from Mr. Mitchell's communication are reproduced :—

Founded in 1901, the Grammar School in St. Kitts has, during the last eighteen years, provided the means of a liberal education for the youth of the Presidency. In purely agricultural communities like St. Kitts and other West Indian islands, the study of Latin is required by a very small minority, and the needs of this minority have been duly provided for. The efforts of the teaching staff, however, have been and still are mainly directed to imparting a sound knowledge of the English language and literature, one modern language (French), Mathematics in its fundamental forms, and Natural Science.

The general principle of the Science teaching has been to direct attention to its bearing upon agricultural processes. The very young boys on entering the school are at once taught to cultivate habits of observation and comparison by a course of Nature Study, which in due time lead easily and naturally to the systematic study of botany. As the pupils move up the school, the same studies are continued in a somewhat more advanced form until the pupils are expected to be in a position to meet successfully the tests applied in the Cambridge University Local Examinations. The advanced pupils, that is, those who remain in the school till they reach the standing of Senior studeuts, in addition to the subjects already mentioned, may elect to take Agricultural Science as a separate but closely allied branch of study.

The course of reading comprised in the term Agricultural Science is very wide, and includes a very large number of issues, among which may be mentioned chemical changes affecting soils, manures natural and artificial, staple crops and their requirements, field processes such as pruning, propagation, grafting and budding, the methods of dealing with weeds and pests, the essential food material for plants and working stock, etc. Pupils who have passed in this subject are granted the Preliminary Certificate of the Imperial Department of Agriculture in connexion with the Reading Courses for overseers and planters.

During the past eighteen years about 210 boys have received their education at this school and have passed out to take their places in the actual business of life. A few have proceeded to Universities with the object of fitting themselves for various professions, chiefly medicine, civil and mechanical engineering, and agriculture. In every case these have acknowledged the great value of the preliminary teaching they received at school in the Natural Sciences and Mathematics.

A larger number of boys have entered the Public Service in various capacities, and it is a noteworthy fact that the higher subordinate posts in the Agricultural Department of the Presidency have been very generally filled by former pupils of the school.

Others again have occupied positions as assistants to the chemist at the Basseterre Sugar Factory.

The remaining pupils on leaving school have adopted agriculture or mercantile business as their calling.

The leaven of accurate scientific knowledge is well known to be extremely slow in operation, and takes a long time in making itself apparent in any community; but it cannot be questioned that those who have been carefully taught on correct lines in their early years, are not likely to content themselves with the old rule-of-thumb methods. A distinctly higher plane of thought, and a desire for investigation to discover the reasons for observed phenomena in the field and in handling products, is slowly but very surely taking the place of the old idea that the final stage in agricultural knowledge has been reached. Impatience and the expectation of quick returns from educational influence in any direction or department of life are fatal; the former is perilously liable to destroy whatever has been laboriously accomplished, and the latter is doomed to disappointment beforehand.

Secondary education in the British West Indian islands owes a great debt to the Imperial Department of Agriculture, and this is particularly the case in St. Kitts. The Department made large grants for converting the buildings of the former Technical Institute into a form suitable for a combined Grammar and Agricultural School, for erecting a residence for the Head-master, and for establishing and equipping a small chemical laboratory. Besides all this, the Department provided the salary of a Science Master, and expended the sum of £90 annually in scholarships for eleven years. In this way, a secondary school, in which careful provision was made for natural science teaching, was placed upon a firm basis for, perhaps, the first time in the history of the Presidency. During the last seven or eight years the work has been continued on the same general lines by the local Government, the Imperial Department always taking a direct interest in its progress and development

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

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†Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial draws attention to the Report recently presented to the Secretary of State for the Colonies by the Committee appointed last year to deal with the question of a Tropical Agricultural College in the British West Indies.

A continuation of the article on the Panana disease of bananas will be found under Plant Diseases on page 78.

The reqort of the Empire Cotton Growing Committee, which has lately been presented to the President of the Board of Trade, is dealt with on page 68.

An interesting article on the St. Kitts Grammar School appears on page 71.

Former Land Connexion of Central America and the Antilles.

Prof. W. Trelease recently contributed a discussion to the *Bulletin of the Geological Society of America*, on the bearing of the distribution of some elements of the existing flora of Central America and the Antilles on former land connexions in this area. The following notice of the Professor's paper appeared in *Nature*, January 8, 1920 :—

'The most important evidence seems to be supplied by the genus Agave, which includes the familiar century plant. Its chief centre is Mexico, but it ranges from Arizona to the Isthmus of Panama, and occurs also in tropical Florida, and southern equatorial America. It is represented in the West Indies by about fifty endemic species, comprising six distinct types, and from their distribution in the islands the author concludes that the genus was derived from the mainland of Central America at some late Tertiary or early Quaternary time when islands and continents were continuous. Later it spread through the chain over continuous land; the continuity was broken by subsidence or faults when the very deep Anegada Passage, which separates the islands of St. Thomas and St. Croix, was formed, and later subsidences have caused in succession the deeper and lesser water gaps by which the Antilles are divided into groups, successively more or less distinct in their agave flora. These conclusions would indicate that the greatest break between the Northern and Southern elements in the Antillean flora coincides with the deepest, and presumably the oldest, break in the Antillean bridge, now represented by the Anegada Passage.'

Prickly Pear, A Pest in Australia.

Bulletin No. 12 of the Institute of Science and Industry of Australia, deals with the prickly pear. As *Science Progress*, January 1920, remarks in a note on the subject, such a publication is an evidence of the serious losses which may be suffered by a country from imported pests.

Prickly pear was first introduced into Sydney about 1788 ; but it seems probable that the plants then imported subsequently died, and that the plants which now cover 22,000,000 acres owe their origin to one brought to Scone (about 200 miles from Sydney) in 1839. It was propagated purposely as a hedge plant, and as a stand-by for stock in a drought year. It grows very fast, and in one case on record advanced in a solid mass for half a mile on a four-mile front in two years.

Prickly pear cannot be employed commercially for any purpose save as a green manure on soils deficient in humus. To eradicate it seems especially difficult, but it is hoped that some harmless insect may be found which will destroy it. With this end in view, the Executive Committee of the Institute recommends that a sum of £8,000 per annum should be provided for a biological expert at a salary of £1,200 per annum, and two entomologists at salaries of £750 per annum.

Citrus Canker in Florida.

According to a note in the *California Cultivator*, January 17, 1920, a report has been issued by the State Plant Board of Florida, which shows that citrus canker has been effectively checked. At one time the disease threatened to destroy the entire citrus industry of Florida. In May 1914, some 13,727 trees were found to be infected with canker. During the five years in which the Plant Board has coped with the situation, there have been found 342,254 trees infected. Of these 234,998 were destroyed by permission of the owners, the trees being burned on the premises. Nursery trees destroyed during this time amounted to 2,613,514. The successful result has been that in May 1919, there was only one tree reported as infected.

An Experiment in Yam Cultivation.

A note in the *Agricultural News*, February 8, 1919, drew attention to an experiment conducted at the Botanic Station, Montserrat, in yam cultivation, as to whether it was profitable or not to provide stakes for the vines to run on. Mr. Robson, the Curator, came to the conclusion that the increased yield produced by the staked plants would more than pay for the increased cost involved.

Mr. Robson has recently forwarded a note upon a similar trial carried out in 1919 with the results obtained therefrom. Six rows of six different varieties of yam were planted on ordinary banks, to which pen manure had been supplied, 4 feet apart, the plants being 3 feet apart in the row. These rows were staked, and five rows unstaked were planted alongside as a control. The yams were planted on May 1, 1919, and reaped on January 19, 1920. The results showed that in every case there was a large increase in yield from the staked rows as compared with the unstaked ones, amounting to more than 100 per cent. on the total yield, thus confirming the results obtained in 1918.

From the rainfall during the eight months that the crop was in the ground, another conclusion arrived at in 1918 was also confirmed, namely, that it is most important to have an ample rainfall in the months of October and November, the critical period for the development of the yam.

Motor Tractor Trials.

The judges' report on the agricultural tractor trials held by the Society of Motor Manufacturers and Traders at Lincoln, in September 1919, is reviewed in the *Field*, January 17, 1920. The general remarks of the judges on the trails as a whole are quoted briefly. From them the following paragraphs are reproduced, as of general interest:—

'We deem it a great necessity that simplicity of construction should be very carefully considered in an agricultural tractor, as they have generally to be worked by men who have little mechanical knowledge, and often at long distances from any place of repair. Strength is very important, both in build and engine power, and it is best to have a considerable reserve of both, as through a sudden and great variation of land a heavy strain is often quickly imparted to the machine. The engine and as many working parts as possible should be well enclosed, as at work, both dirt and dust have to be guarded against.

'While not convinced that it is in every case desirable to have one of the tractor wheels running in the furrow, we observed that when this is the case the tractor is more or less self-steering, and allows the operator to devote more attention to the plough. The furrow wheels, however, should be of such a width as not to necessitate the making of too wide a furrow.

'The use of caterpillar tracks undoubtedly reduces the pressure per square inch on the land, and where well designed, may permit of ploughing under conditions where a wheeled tractor could not be used. There is, however, room for further investigation as to the wearing capacity of these tracks and as to whether an efficient system of protection of the wearing parts and their proper lubrication can be devised.

'We consider that a tractor, to be satisfactory for all kinds of farm work, should have three speeds, varying from 2 to 5 miles per hour.

'We were pleased to observe that a large number of the tractors which did good work were of comparatively light weight, and that the tendency of the makers is more and more in this direction'.

Meal as an Antidote to certain Vegetable Poisons.

A note in *Botanical Abstracts*, January 1920, draws attention to a passage in the Bible (II Kings, iv, 38-41) where an account is given of the accidental poisoning of a band of prophets, and the antidotal means employed by their leader, the prophet Elisha. The Hebrew name of the plant that caused the poisoning may be transliterated as Paqqù'ôt, and the antidote used was meal. The derivation of the Hebrew name is given, and it is shown from both the botanical and archæological histories, that it applies rather to the wild Colocynth, *Citrullus Colocynthis*, than to the squirting cucumber, *Ecballium Elaterium*. Both plants are powerful drastic purgatives, and in overdoses are dangerous poisons, producing entiritis and even death. To test the use of meal as an antidote, experiments have been carried out on dogs. A striking primary symptom was profuse salivation, which will account for the exclamation of the prophets, on eating their pottage, of which the wild Colocynth was a part, that there was death in the pot. The flour or meal rendered the otherwise poisonous and lethal doses of the plant under discussion innocuous, substantiating the truth of the biblical passage. and sustaining the popular first aid maxim to give flour in many cases of poisoning.

INSECT NOTES

THE BED BUG.

The presence of the bed-bug in a house is not necessarily an indication of neglect or carelessness ; for this insect may gain access in spite of the adoption of all reasonable precautions. It is very apt to get into the trunks and bags of travellers, or into baskets of laundry, and may thus be introduced into homes. Unfortunately also, it is quite capable of migrating from one house to another, such migration being especially likely to take place if the human inhabitants of a neighbouring infested house have left it. With the failure of their usual source of food, the migratory instinct of the insects is developed, and escaping through windows, they pass along walls, water-pipes, or gutters, and thus gain entrance into adjoining houses. In these or other ways anyone's house may be invaded. Nevertheless, the presence of the bed-bug in a house, both from the standpoint of personal comfort, and the possible carriage of disease, is not to be lightly considered, and immediate efforts of eradication should be undertaken.

Farmers' Bulletin, No. 754, of the United States Department of Agriculture, after giving a general account of this offensive house pest, suggests effective means by which it can be promptly eradicated. The following paragraphs are reproduced from the above mentioned bulletin:—

As with nearly all the insects associated with man, the bed-bug has had the habits now characteristic of it as far back as records run. It was undoubtedly of common occurrence in the dwellings of the ancient peoples of Asia. The Romans were well acquainted with it, giving it the name Cimex. It is said to have been first introduced into England in 1503, but the references to it are of such a nature as to make it very probable that it had been there long before. Two hundred and fifty years later it was reported to be very abundant in the seaport towns, but was scarcely known inland.

One of the old English names was "wall-louse." It was afterwards very well known as the "chinch," which continued to be the common appellation for it until within a century or two, and is still used in parts of the United States. The origin of the name "bed-bug" is not known, but it is such a descriptive one that it would seem to have been naturally suggested.

The bed-bug has accompanied man wherever he has gone. Ships are very apt to be infested with it, and have been the chief means of its wide distribution. It probably came to the United States and the West Indies with the earliest colonists.

The bed-bug (*Cimex lectularius*, L.) belongs to the order Hemiptera, which includes the true bugs or piercing insects, characterized by possessing a piercing and sucking beak. Like nearly all the insects parasitic on animals, it is degraded structurally, its paristic nature having resulted, after many ages doubtless, in the loss of wings, and the assumption of a comparatively simple structure.

A characteristic feature of the bed-bug is the very disgreeable odour which it exhales. This odour is characteristic of most plant-bugs also, and is as pungent in hese plant-feeding forms as in the human parasite. In the plant-feeding forms this odour doubtless is a means of protection against insectiovrous birds. In the bed-bug, on the other hand, it is probably an illustration of a very common phenomenon in the animal world, namely, the persistence of a characteristic which is no longer of any special value to its possessor.

Normally the bed-bug is nocturnal in its habits, and seems to display what be termed a certain degree of caution and intelligence in its efforts at concealment during the day. Under the stress of hunger, however, it has been known to attack human beings voraciously in broad daylight. It usually leaves its victim as soon as it becomes gorged with blood and retires to a place of concealment, either in cracks in the bedstead, partitions, or walls or under loose wall-paper, and in these and similar places it collects in masses. It thrives particularly in dirty rooms, and in old houses, which are full of cracks and crevices. The old-fashioned wooden bedsteads afford favourable situations for the concealment and multiplication of this insect, and the use of iron and brass bedsteads facilitate its eradication.

Like the other Hemiptera, the bed-bug undergoes what is known as an incomplete metamorphosis. In other words, the insect from its larval to its adult stage is active, and without marked differences in form, structure, and habit.

The eggs are white, oval objects, which may be found in batches of from six to fifty in cracks and crevices where the parent bugs go for concealment. In warm weather the eggs hatch in a week or ten days, but this period is lengthened under conditions of cold.

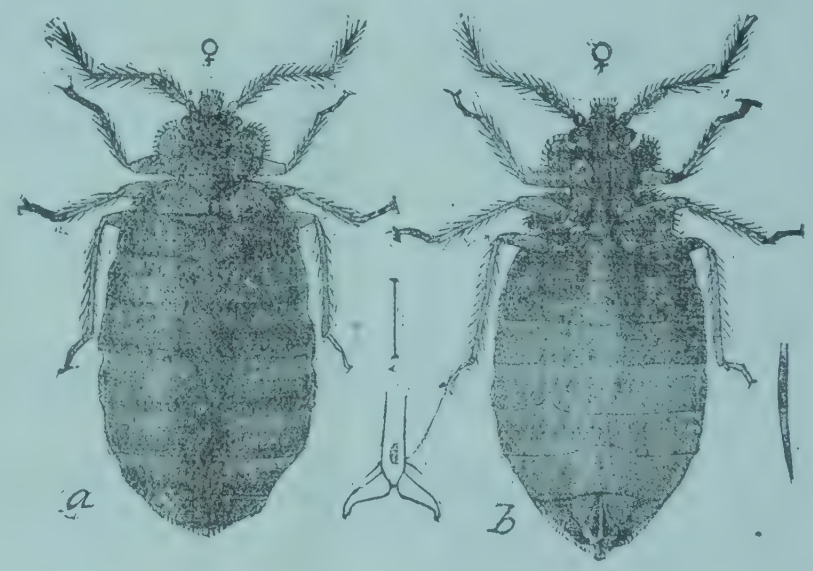


Fig. 2 Bed-bug (*Cimex lectularius*).
(a) Adult female gorged with blood; (b) same from below.
(From U. S. Department of Agriculture.)

During the course of its development the bed bug normally sheds its skin five times, then becoming adult. Under favourable conditions of temperature and food it has been found that a period of about seven weeks elapses from egg to adult insect.

Investigations indicate that ordinarily only one meal is taken between moults, though additional meals may be taken particularly when the insect has been disturbed at its first meal after a moulting, before having become fully gorged. The bedbug takes from five to ten minutes to become gorged with blood, then retires to its place of concealment for six to

ten days for the quiet digestion of its enormous meal. Under normal conditions, the food of the common bed-bug is obtained from human beings only. The abundance of this insect in houses which have been long untenanted can be explained by its natural longevity, and its ability to survive for a year and perhaps more without food. Specimens have been kept for a year in a sealed vial without any means of sustenance whatever.

The fact that the bed-bug is able to survive for such long periods without human blood has led to a theory that it could subsist in some fashion on the moisture from wood, or from accumulations of dust in crevices. There does not seem, however, to be any basis of observed fact for this idea.

In common with other insects which attack man and other warm-blooded animals, it is quite possible for the bed-bug to be a transmitter of contagious diseases; these insects have been shown to be possible carriers of a considerable number of diseases, including possibly leprosy. The particular way in which the bed bug acts as a carrier of disease has not yet been satisfactorily determined, nor has it been shown that it is a necessary alternate host in any instance. In general, the transmission of disease by this insect has apparently resulted from the carriage of disease germs on the mouth-parts.

The most efficient remedy for the bed bug is to fumigate the infested house or rooms with hydrocyanic acid gas, which will penetrate into every crevice. This gas is deadly poisonous to human beings, and should only be employed with the greatest precaution.

The fumes of burning sulphur are also a very efficient means of control where this method can be used. There is, however, a considerable risk of injury to fabrics and furniture.

Where the employment of a poisonous or troublesome gas is impracticable, simple methods of control are effective enough, though involving a greater cost of time and effort. Of these simple methods of control perhaps the most efficient is liberal applications of benzine, or kerosene, or any other of the lighter petroleum oils, introduced with small brushes or feathers, or by injecting with syringes into all crevices of beds, furniture, or walls where the insects may have concealed themselves. Corrosive sublimate is also of value, and oil of turpentine used in the same way. The liberal use of hot water, wherever it may be employed, is also an effectual method of destroying both eggs and bugs.

The maintaining of a high temperature may be an even more efficient method of control. A temperature of 113°F. will in a few minutes destroy the active bugs and also the eggs. A test of this method of control was made on an eight room two-story frame house, badly infested with bed-bugs. The temperature was raised one day in the month of July from 77° to 160° F. by warming the rooms with artificial heat, and closing them from 9.30 in the morning to 7·30 in the evening. By 4·30 p.m., when the temperature in the different rooms ranged from 127° to 148° F., all the insects were dead; the continuation of the experiment was on the supposition that it would probably require a higher degree of temperature to destroy the eggs. The eradication of the bed-bugs from this house was complete, and no damage was done to the house or its contents. It may be mentioned that the temperature was also sufficient to destroy fleas cockroaches, and other insects.

It would seem, therefore, that superheating of houses to a temperature of 120° to 130° F. may prove to be one of the simplest and most effective means of eradication of this and perhaps other houshold pests.

PASSENGER-CARRYING BIRDS AND INSECTS.

Dr. L. W Sambon, lecturer to the London School of Tropical Medicine read a paper on 'Tropical and sub-Tropical Diseases' at a meeting of the Royal Colonial Institute, held at the Central Hall, Westminster.

Dr. Sambon said it was parasitism, and not climate, that opposed colonization in tropical countries. Speaking of a maggot disease of man due to a fly called *Dermatobia hominis*, he said the female fly pounced upon a mosquito and deposited upon it a cluster of eggs. The mosquito, when released, flew away like a fighting aeroplane laden with bombs. As soon as it had settled on a victim, the larvae left their egg-shells and crept into the wound which the mosquito inflicted. The common house-fly was also often used as a flying machine by *Chernes nodosus*, which clung to its legs just to be carried to another place. Even the higher animals were said to avail themselves of 'aeroplanes,' and many small birds, incapable of long flight, had been seen travelling on the backs of migrating cranes. The story of the Dermatobia was wonderful, but not more so than that of a thousand and one other strange parasites more changeable in form than the old man of the sea, and whose ordinary mounts were rats, birds, lizards, fishes, fresh-water crabs, pond snails, ticks, lice, flies, and fleas.

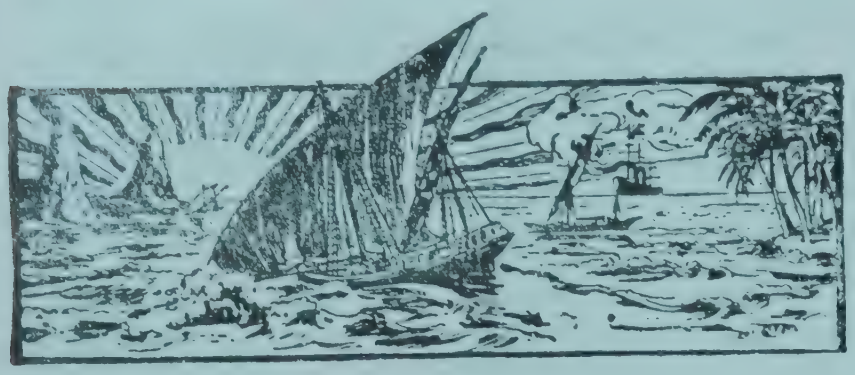
THE RAT CAMPAIGN.

Referring to the action taken in England for the extermination of rats, Dr. Sambon said he had little faith in the success of a general crusade against these animals. Experience had shown again and again that rat extermination was practically impossible The slaughter of rats only rendered conditions more favourable for the multiplication of the survivors, and the rat's breeding powers were incredible. What we could and should do was to render our wharves, quays, markets, storehouses, and other public buildings rat-proof. The rats must be entirely excluded from occupied buildings. The proper storage of food, the burning of food wastes and garbage, the destruction of places where the rat might find harbourage, architectural modifications to cut off his approach, the liberal use of concrete, wire-netting, and sheet metal, would certainly discourage him. The ancients protected the natural enemies of the rat, and made special use of rat-eating snakes. Both in sanitation and preventive medicine the ancients were our superiors.

In 1913, when he visited the West Indies on behalf of the Colonial Office to investigate pellagra, he found such diseases as elephantiasis, ankylostomiasis, yaws, and leprosy rampant. He believed that the medium of leprosy infection should be looked for among culicoides and other such midges. Impressed by what he had seen in the West Indies, he suggested that the Lesser Antilles should be chosen to carry out a medical survey which might make it possible to study the œcology of tropical diseases. A powerful committee was now being formed to carry out this work. (*The Times*, January 28, 1920.)

DEPARTMENT NEWS.

Sir Francis Watts, K.C.M.G., D. Sc., Imperial Commissioner of Agriculture for the West Indies, left Barbados in R.M.S. Caraquet on March 3, for Antigua, on official business. He is expected to return in a fortnight's time.



GLEANINGS.

According to estimate, the sugar output of Hawaii for 1920 will be 562,413 short tons. This estimate is about 40,000 short tons below the output in 1919, and is a very serious disappointment to the calculation that Hawaii might sensibly help to relieve the acute sugar shortage. (*Sugar*, November 1919.)

The imports into Dominica from British North America in 1906 were valued at £4,774. In 1915, the first full year of the preference, the imports reached £29,613. Since then the imports from Canada have increased each year; last year they stood at £57,489. (*Weekly Bulletin*, Department of Trade and Commerce, Canada, December 29, 1919.)

Comparison of Europe's beet sugar production, for the season 1919-20 of possibly 2,600,000 tons, with the pre-war production of over 8,000,000 tons, reveals the low state to which the great beet sugar industry of Europe has fallen. Instead of producing half the yearly world supply of sugar, Europe now contributes only about one-sixth of the total. (*Facts About Sugar*, January 24, 1920.)

In British Guiana some molasses is made into a feeding stuff known as 'molascuit', made by mixing 4 parts of molasses of 48° to 50° Baumé density, with one part of the finely divided tissue obtained from megass. The moisture content of the product must not be over 12 per cent., as it is otherwise liable to undergo spontaneous combustion. (*Sugar*, November 1919.)

In the Dominican Republic the sweet potato weevil (*Cylas formicarius*) is responsible for the loss of some 60 to 90 per cent. of the sweet potato crop, many fields having been abandoned owing to its depredations. The eggs are laid on the roots, and the larvae after hatching penetrate into the tubers, giving them such an unpleasant taste that even pigs refuse to eat them. (*Revista de Agricultura*, Santo Domingo, August 31, 1919.)

Sugar, November 1919, suggests that it may perhaps be good policy on the part of central factories which have been converting a large proportion of their molasses into alcohol, to experiment with the use of the alcohol as an auxiliary fuel with megass. The cost of distillation of crude alcohol from molasses is exceedingly small, while its fuel value cannot be denied. A proper utilization of alcohol as fuel in sugar centrals would seem a logical development of the near future.

Experiments carried out by the Agricultural Department, New South Wales, with Washington navel oranges and with lemons, as to the comparative values of curing treatments, gave the following results: lemons dipped in borax and packed in paper-lined cases, also in sand, were not satisfactory; lemons treated by receiving a coating of vaseline kept in perfect condition from June to January. (*Journal of Agriculture*, Victoria, Australia, November 18, 1919.)

The continuance for some time of the present shortage of celluloid must be considered certain. The supply of camphor for this manufacture is restricted by the Japanese Government, and as matters now stand, the erection of additional celluloid factories would mean merely a reduction of the ration of camphor to existing works. The production of celluloid in Japan amounts to 6,000,000 lb. a year, worth approximately £1,300,000; it has trebled since the war. (The *India Rubber Journal*, January 3, 1920.)

Prices in Guadeloupe for coffee are said to be the highest ever known. It is shipped exclusively to France, where it is known as a 'café de luxe,' and sells at highest prices, corresponding with the Blue Mountain coffee of Jamaica. The coffee planters have given up the old idea that coffee trees continue to yield large crops twenty-five years after planting. Now, as soon as they find the older trees giving signs of a dwindling crop, they replace them with young trees. (The *West India Committee Circular*, January 8, 1920.)

The New Zealand *Journal of Agriculture*, November 20, 1919, notes the world's record for milk production by a goat. This goat, California Gretel, a Toggenburg, produced 294 gallons of milk in 365 days. This record is all the more remarkable when it is remembered that the average yearly production of milk per cow in Canada is only about 300 gallons. That so much milk could have been produced by such a small animal as the goat would hardly have been believed possible a few years ago. This record is officially substantiated, it having been made at the California University Farm.

According to *Colonial Reports*—Annual, No 1014, more than nine-tenths of the total area—73,565 acres—under sugar cane in British Guiana in 1918 was planted in varieties other than the Bourbon. Only 3,500 acres are now occupied by Bourbon unmixed with other varieties. Of the area, estimated at 69 000 acres, cultivated in new varieties, 92 per cent. was under canes raised from seed in the colony, while about 7½ per cent. was occupied by varieties imported from Barbados. Of the total area under cane cultivation, 78 per cent. is occupied by new varieties raised at the Georgetown Botanic Gardens.

Dr. J. C. Hutson, Entomologist on the staff of the Agricultural Department, Ceylon, states in the *Tropical Agriculturist*, August 1919, that owing to the late planting of cotton there had been a severe outbreak of *Dysdercus cingulatus*, a cotton stainer, which apparently has similar habits to allied species in the West Indies. The local food plants, as in these islands, include the silk-cotton tree (*Eriodendron anfractuosum*). The insects also feed in Ceylon on the red cotton tree (*Bombax malabaricum*), okra (*Abelmoschus esculentus*), and the ornamental *Hibiscus rosa-sinensis*.

CHRYSIL RUBBER.

This is the product of the rubber-bearing shrub *Chrysothamnus nauseosus*, which is found in Western North America, and has been studied and experimented with along with other rubber-bearing shrubs in that region, by Professors Hall and Goodspeed, of the University of California, who have recently presented their report, which the *India Rubber World* (January 1, 1920) regards as one of the most complete, scholarly, and practical treatises of the day. The report of Dr. David Spence on a sample of this rubber, which was forwarded by the investigators with the object of getting some idea of its value, was to the effect that the rubber was of 'high grade and average quality, not as good as the best fine Para, but a great deal better than most Africans or low grade rubbers'.

The Chrysothamnus, or 'rabbit bush,' is very widely distributed. The investigators found that 'they range in altitude from about sea-level in some of the desert basins to 8,000 feet in the southern Colorado mountains. Some varieties occur at even higher altitudes, but they have not been examined as to their rubber content. The plants are most abundant and of maximum size in the Great Basin area, becoming more and more scattered and apparently diminishing in their percentage of rubber as we pass from this centre of distribution.'

It should be noted by the way, that the Chrysothamnus is not a latex-producing plant. The rubber is found in the individual cells of the shrub, as in guayule. Like guayule also, it is found principally in the parenchymatous elements of the cortex. It may also be noted that rubber does not appear to be laid down in the first year of growth of a tissue, and, indeed, unless present in large amount, is not readily detected by the histological method in portions of the plant less than three or four years old.

Shrubs of interest as possible rubber producers are usually of good size, measuring 3 to 8 feet high, and about as broad. The rubber is present for the most part in the inner bark of the stems, and those portions in average mature plants will weigh from 5lb. to 15lb. An exceptionally large plant found near Lone Pine, California, weighed 60 lb. exclusive of the twigs, and shrubs weighing 20 to 40 lb are not rare. This is partly because the plants reach the maximum size only under favourable conditions, and partly because they are frequently burned or cut off near the base, after which new stems shoot up only to be again destroyed before reaching maturity.

Another shrub that is treated at length is the Haplopappus, which contains considerably more rubber than the Chrysothamnus, from 6 to 10 per cent. The product is, however, soft and resinous.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets for the month of January :—

In reviewing the condition of the London produce markets during the month of January—more practically with regard to bulk, rather than that of prices—it must be remembered that the month under review consisted of five weeks, the first auction falling on the first day of January and the last on the 29th of the same month, though the first, day of the New Year is always observed as a holiday in all branches of the produce markets. With regard to prices generally, they still continue on an upward scale. The following are some of the principal items.

GINGER.

It was stated at the first auction in January that there were heavy stores in London of Jamaica and Cochin; a week later some 100 bags of wormy Cochin were sold at 75*s*, per cwt. At the same auction some sales were effected of Japanese, at 60*s*. per cwt. A week later the price paid for Japanese was 62*s*. 6*d*., and Cochin and Calicut had slightly advanced. At the auction on the 22nd of the month it was reported that there was a fair export trade being done with America in Jamaica ginger, at prices varying from 90*s*. to 100*s*. per cwt., and for better qualities at from 110*s*. to 120*s*. Quite at the end of the month it was stated that the exports of Jamaica ginger to America were being continued at firm prices.

NUTMEGS, MACE AND PIMENTO.

At the beginning of the month, West Indian nutmegs were reported as being very scarce, but further supplies were anticipated later in the new year, which was to some extent realized at auction on the 15th, when 894 packages of West Indian were offered and sold at a reduction in price of from 2*d*. to 3*d*. per lb. West Indian mace was in good supply at auction on the 15th of the month, being represented by 264 packages, all of which were disposed of at the following rates : good palish 1*s*. 8*d*. to 1*s*. 10*d*. per lb. ; reddish to fair 8*s*. 5*d*. to 1*s*. 7*d*. ; dark 1*s*. 1*d*. to 1*s*. 2*d*., and broken 9*d*. to 1*s*. At the beginning of the month Pimento was in steady demand at 6*d*. per lb., a price which varied to $6\frac{1}{4}d$. towards the end.

SARSAPARILLA.

This article was in good supply on the 15th of the month, being represented by 48 bales of grey Jamaica, all of which were sold at 3*s*. 7*d*. per lb. for good sound fibrous, 2*s*. 10*d*. to 3*s*. 4*d*. for rough and slightly mouldy. Some badly wormed fetched 1*s*. 10*d*. ; 52 bales were also offered of native Jamaica, and 20 sold at prices varying from 2*s*. 1*d*. to 2*s*. 6*d* per lb. ; 75 bales of Lima, and 20 of Mexican were also offered, but found no buyers

ARROWROOT, LIME OIL, CASSIA FISTULA, CITRIC ACID, ANNATTO, AND KOLA.

The supplies of St. Vincent arrowroot are reported as abundant at old rates. It was reported in the early part of the month that the exports of distilled oil of limes from St. Lucia in 1918 amounted to 1,447 gallons compared with 300 gallons in the previous year. At auction on the 15th of the month 10 packages were brought forward, but found no buyers. At the same auction Cassia Fistula was represented by 10 packages, all of which were disposed of, fair West Indian fetching 185*s*. per cwt., and a further 6 packages 180*s*. The exports from St. Lucia during 1918 were reported to have amounted to 824 lb. against 1,360 lb. in 1917. It was reported at this auction that very large American orders had been received for citric acid, and some business done at 4*s*. 3*d*. per lb. At a later date it was stated that 4*s*. 6*d*. had been freely paid for ton quantities. At the auction on the 15th of the month Annatto seed was represented by 430 packages of East Indian, 282 of which were sold at 1*d*. to $\frac{3}{4}d$. per lb. below previous prices. At the same auction kola was represented by 611 packages, only 9 of which found buyers at $6\frac{1}{4}d$. to $6\frac{1}{2}d$. per lb.

PLANT DISEASES.

THE PANAMA DISEASE OF BANANAS

(*Continued*).

SYMPTOMS OF THE DISEASE—EXTERNAL.—In a field where only occasional and isolated cases of the disease are found, indicating that the soil has not yet become thoroughly infested, the affected plants are not apt to exhibit any external signs of the disease until after the bunch has started to form. A typically diseased plant first shows a yellowing of the lower or outer leaf-blades and petioles. The transition from the normal dark-green colour of the leaf to a vivid yellow is usually sudden and startling, and proceeds from the margin inwards. Their appearance to one familiar with the disease is said to be unmistakable, and not apt to be confused with any other trouble.* This yellowing of the outer or lower leaves is a practically certain symptom, especially if, as is usually the case, it appears when drought symptoms are not to be expected. There is no risk of confusing it with the normal fall of the lower leaves. In a healthy plant the older leaves gradually and regularly die off from below upward, with only a gradual transition in colour from dark green to brown.

The leaves first attacked by the disease begin to wilt almost immediately. Within a day or two the fleshy leaf-stalk buckles, usually at a point 3 or 4 inches from the stem, and the leaf hangs pendant. Sometimes, however, this buckling of the leaf-stalk or the large mid-rib takes place at any point, out to the middle of the leaf blade or beyond.

The leaf now rapidly withers and becomes brown, and the process is rapidly repeated in other leaves, until the topmost or innermost leaf is reached. Finally this leaf droops and withers, and the plant stands for a few days or weeks with dry brown leaves rattling in the wind, until a puff of wind eventually sends it to the earth, where it quickly rots owing to secondary invasion by putrefactive organisms.

Another symptom of the malady, which may be seen in fields where the disease is of long standing, is a decided dwarfing or stunting of the whole plant. The stems of these stunted plants have a 'hide-bound' appearance, and the leaves are curved or distorted, although they do not wilt so rapidly as those of larger plants, nor is the yellow colour so conspicuous.

Another symptom that frequently accompanies this stunted condition is a longitudinal splitting of the leaf bases. Only the outer leaf-bases may be involved, or sometimes the split may extend to the centre of the stem, in which case it sometimes happens that the young leaf in the centre becomes diverted from its course upwards, and grows out through the split.

If a bunch of fruit has formed on a diseased plant, it will generally be found to be small. Development may be completely arrested after a few hands have been formed, and the individual fruits are small, and pinched in at the calyx end. Occasional fruits scattered through such a bunch become yellow rapidly. The flesh is inclined to be pithy, acrid, and yellowish.

INTERNAL SYMPTOMS.—Healthy banana tissue when first cut open is almost dead white. After a few minutes, especially if it has been cut with a steel knife, a purplish discoloration will appear uniformly distributed over the cut surface, due to the presence of oxidising enzymes.

A section of a plant in the incipient stages of this disease presents quite a different appearance. Small dots and irregular threads of a yellowish or light-brown colour are to be seen, either distributed evenly over the whole cut surface or more frequently arranged in a band. Sometimes they are localized in one or more patches. These dots and threads are discoloured vascular bundles, and in later stages of the disease they become more numerous, their colour ranging from reddish to reddish-brown. At a quite advanced stage of the disease the vascular bundles change in colour from reddish-brown to purple or even black. Secondary rots have set in by this time, and as these rots are occasionally putrefactive, a disagreeable odour is sometimes given off.

Unmistakable evidence of the disease may be found in the roots also. Blackened roots close to the rhizome, and extending into its diseased portion, are frequently found. This condition has been proved to be due to the organism causing the disease.

CAUSE OF THE DISEASE.—This causal organism is a fungus, to which the name *Fusarium cubense* has been given. It is a typical member of the genus Fusarium, and exhibits near relationship to other species, notably *F. vasinfectum*. On account of its constant association with the disease the ability of *F. cubense* to cause the wilt has been assumed for some time. Dr. Brandes seems to have proved most convincingly, by a series of experiments which he records, that there is no doubt any longer but that *F. cubense* is the cause of the Panama disease of banana.

There are good grounds for assuming that the fungus excretes substances that are poisonous to many plants. It would seem, for instance, from the results of an experiment with cotton seedlings, that these are liable to infection and destruction when planted in soil heavily infested with the causal organisms of the Panama disease.

It appears that this aggressive parasite is known to attack only four or five of the hundreds of varieties of banana.

DISSEMINATION OF THE DISEASE.—As was noted in the first part of this article, owing to the carelessness of man, this disease has been widely distributed by the planting of diseased suckers. If there were no other method of spreading the disease, it might be restricted to the progeny of originally diseased plants. Unfortunately, however, nature has provided for an almost unlimited dissemination of the disease-causing organism to new localities under the proper conditions in the following ways.

The fungus produces innumerable spores on both surfaces of the leaf blade, on the leaf-stalk, or even on the leaf bases, apparently at any time of the year, the governing factors being the stage of the disease, and the high atmospheric humidity or abundant rainfall.

These microscopic spores are easily dislodged when dry by the wind, and carried in all directions on slight currents of air, as they are extremely small and light. How far these spores may be carried by the wind without losing their vitality is not known, but theoretically, a distance of many miles is possible, so that it may be assumed that the only practical limit in their dissemination by wind agency is only their deathpoint.

In the tropical rains, which are so common in many banana producing countries, the water frequently accumulates on the surface of the ground so rapidly that it is not easily absorbed, but runs in sheets or streams for considerable distances. There can be no doubt that this affords a ready means for the dispersal of the spores for short distances.

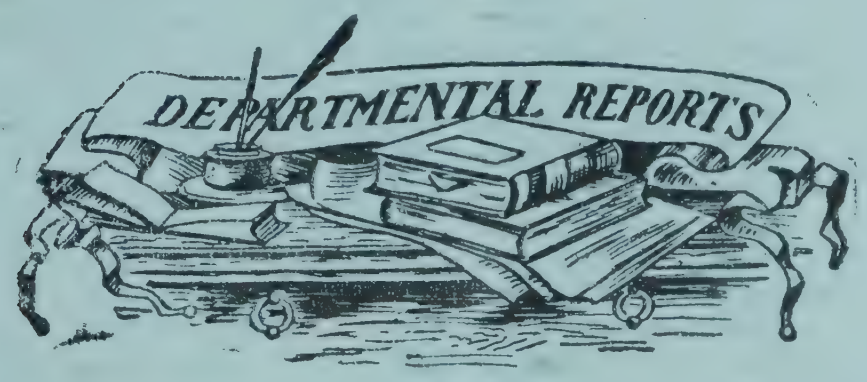
* A similar appearance is produced by infestation of the roots with nematodes. (See *Agricultural News*, Vol. XVII, p. 206; *West Indian Bulletin*, Vol. XVII, p. 177).—W.N.

It has been abundantly proved that the fungus may remain alive in the soil in some form or other for long periods of time. It has also been proved that the organism is capable of growing in the soil. It is evident, therefore, that if healthy bulbs are planted on such soil, they will probably become infected. This leads to the consideration of another method of distribution of the fungus, namely, that mud carried on the feet of men and animals, or on the wheels of vehicles, may serve as a medium for dissemination of the fungus for great distances.

Infected banana leaves are frequently found among the 'trash' used for protecting bunches when they are packed for transport to the steamers. This trash is often carelessly thrown about at varions points along the route, and has probably aided in the distribution of the fungus.

Insects may act as carriers, but there is no definite information on this point, and probably it is of little importance.

(To be concluded.)



ST. VINCENT: REPORT ON THE AGRICULTURAL DEPARTMENT, 1918-19.

In the Botanic Garden some attention has been paid during the year under review to the raising of Bougainvillaea hybrids. These investigations and the results obtained from them will probably be of great interest in the future. Other plant breeding experiments have been noticed in the previous issue of this Journal.

One of the oldest trees in the Botanic Garden is a camphor tree, probably planted between 1786 and 1806. No flowers have been produced by this tree, and from investigation of the wood at the Gavernment Laboratory, Antigua, it was found to be of a variety which does not yield solid camphor, but only oil.

The manurial experiments which continue to be conducted with Sea Island cotton and arrowroot confirm the conclusions arrived at in previous years, namely, that the element most necessary for application to the soils of St Vincent, in order to obtain the best results from both these crops, is potash. An application of potash alone is apparently more beneficial than a combination of phosphate and potash.

With regard to the cotton crop, spraying experiments with the object of determining whether certain fungus diseases could be controlled, were made; the spray used was Burgundy mixture, the composition of which was as follows:—

Copper sulphate	9¾ oz.
Washing soda	11 "
Milk	¾ pint
Water	3 gals.

In using this spray it was evident that at this strength it injured the plants, so the mixture was diluted to 40 per cent. The plots were sprayed thirteen times; half of each plot was left unsprayed as a control. Spraying had the effect of controlling almost completely the Angular Spot disease. Spraying cannot, however, be advocated as a sound measure, because it injures the flower buds and considerably reduces the number of flowers per plant Possibly, however, a single spraying, when an epidemic of Soft Rot is threatening, would repay the planter, seeing that this disease is capable of destroying half the crop in a few days.

Extensive breeding experiments with Sea Island cotton have been continued. A heavy-yielding type of Sea Island cotton has been isolated, and it is hoped that all cotton growers will soon have the opportunity of obtaining seed of this type.

The study of the life-history of cotton stainers and other plant bugs is being continued. This, together with determined efforts to destroy the wild host plants of the cotton stainer, has proved effective in controlling to a large extent the damage done to the cotton crop by these insects, which in former years, was very serious.

The action taken with regard to the conservation and preservation of locally grown foodstuffs is worthy of all commendation, for large and valuable supplies of food have been preserved in the colony, and rendered available at opportune times. The products dealt with were corn, pigeon peas, cacao, and rice. These were fumigated and stored at the rate of 1*d.* per cwt. per week. The quantity of produce actually dealt with and stored was 396,513 lb.: of this 311,612 lb. was corn, the bulk of which was kiln dried before being stored and fumigated.

The progress of the cotton industry in the colony is continuing, as evidenced by the fact that 6,030 acres were planted in the year under review, compared with 4,710 acres in the previous season, the chief increase being in Sea Island cotton. The average yield of Sea Island cotton was 95·4 lb. per acre; the highest price for Superfine being from 50*d.* to 55*d.* per lb.

A warning to cotton planters against neglecting measures which will maintain the fertility of their land was emphasized by the Imperial Commissioner of Agriculture in an address delivered to the St. Vincent Agricultural Society.

The historic arrowroot industry of St. Vincent, it is suggested, might be improved by labour-saving devices and the centralization of manufacture.

Considering the high value at present of sugar products, it is advocated that attention might be given to more extended manufacture of syrup in St. Vincent, especially as there may be areas in the cotton districts capable of growing sugar cane as a rotation crop, as is done in St. Kitts, to the benefit of both the crops.

The large extension in the cultivation of Indian corn is worthy of notice. Corn is grown chiefly as a catch crop with cotton, arrowroot, and other crops, and yet the local demand for corn and corn meal has been fully supplied, and St. Vincent was able, in addition, to export 3,037 bushels.

Extension of the areas planted in coco-nut is noticed, and a timely warning is given to coco-nut planters with regard to the close attention in the matter of manure and cultivation necessary to render the undertaking profitable. Young trees particularly should on no account be neglected, for once they recieve a check, they never fully recover, or equal those that have had consistently good treatment.

Among the minor exports, ground nuts, pigeon peas, and black-eye peas are noticed as giving good returns.

During the year under review the rainfall in St Vincent at the Botanic Garden totalled 107·98 inches, being 12·21 inches above the average, the wettest month being August, during which 17·14 inches were recorded.

MARKET REPORTS.

London.—The West India Committee Circular, January 8.

Balata—Venezuelan Block, no quotations ; West Indian Sheet, No quotations.
Beeswax—No quotations.
Cacao—Trinidad, 130*s*. Grenada, 127*s*. Jamaica, St. Lucia, St. Vincent, and Dominica, 115*s*. to 127*s*.
Copra—No quotations
Honey—No quotations
Lime Juice—Raw, 2*s*. 6*d*. ; Concentrated, no quotations.
Pimento—No quotations
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T S. Garraway & Co., February 17.

Arrowroot—$9·00 per 100 lb. duty paid.
Cacao—No recent sales
Coco-nuts—$45·00 husked nuts.
Hay—$5·50 per 100 lb.
Onions—Lottings at $20·00.
Peas, Split—No quotations; Canada, Market bare.
Potatoes—Market bare.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, January 20.

Bay Oil—23*s*. 6*d*.
Lime Oil—4*s*. 3*d*. for West Indian distilled, and 10*s*. for hand-pressed.
Orange Oil—West Indian, 25*s*.

Trinidad.—Messrs. Gordon, Grant & Co., February 4.

Cacao—Venezuelan, $26·50 ; Trinidad, $25·75. to $26·00
Coco-nut Oil—$2·10 per gallon.
Coffee—Venezuelan, 24c. per lb.
Copra—11½c. per lb.
Dhal—$12·00 to $13·00
Onions—$10·00 per 100 lb.
Peas, Split—$12·00 per bag.
Potatoes—English, $6·00 per 100 lb.
Rice—Yellow, $12·00; to $13·00 White, $12·00 per bag.
Sugar—No sales made.

New York.—Messrs. Huth, Gillespie & Co., Inc. February 3.

Cacao—Caracas, 24c. Grenada, 20c. Trinidad, 21c. ; Jamaica, 18c. to 19c.
Coco-nuts—Jamaica selects, $65·00 per M; Trinidad $42·00 per M; culls, Jamaica, $65·00 ; Trinidad $42·00 per M.
Coffee—Jamaica, 19c. to 25c. per lb.
Ginger—21c. to 24c. per lb.
Goat Skins—Jamaica $1·60; Antigua and Barbados; $1·55 to $1·60 ; St. Thomas and St. Kitts, $1·55
Grape Fruit—Jamaica, $3·00 to $4·50.
Limes—8c. to 8½c.
Mace—40c. to 42c.
Nutmegs—27c. to 28c.
Oranges—$4·00 to $4·50.
Pimento—9¾c. to 10c. per lb.
Sugar—Centrifugals, 96°, 11c. c. & f. ; Muscovados, 89°, 11c. Molasses, 89°, 11c.

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AGENTS FOR PUBLICATIONS OF THE IMPERIAL DEPARTMENT.

London: Messrs. Dulau & Co., Ltd., 34-36, Margaret Street, Cavendish Square, W.
West India Committee, 15, Seething Lane.
Barbados : Advocate Co., Ltd., Broad Street, Bridgetown.
Jamaica : The Educational Supply Company, 16, King Street, Kingston.
British Guiana : The Argosy Co., Ltd., Georgetown.
Trinidad: Messrs. Muir-Marshall & Co., Port-of-Spain.
Tobago: Mr. C. L. Plagemann, Scarborough.
Bahamas: Mr. H. G. Christie, Board of Agriculture, Nassau
Grenada: Messrs. Thos. Lawlor & Co., St. George.
St. Vincent: Mr. J. D. Bonadie, 'Times' Office.
St. Lucia: Mr. R. W. Niles, Botanic Station.
Dominica: Mr. J. R. H. Bridgewater, Roseau.
Montserrat: Mr. W. Robson, Botanic Station.
Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre.
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 801, Yonge Street, Toronto

AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

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A Tropical Agricultural College in the British West Indies.

II.

THE recommendations of the Committee concerning the Staff of Professors and Lecturers which should be provided for the proposed Agricultural College is that it should consist of the Principal and a certain number of Professors, who should form the Academic Board of the college, and should have charge of the students, and be responsible to the Governing Body for their discipline and for the details of the instruction imparted to them.

The Committee consider that, from the inception of the college, Professors should be appointed in the following subjects: (1) General Agriculture; (2) Mycology; (3) Entomology; (4) Agricultural Chemistry; (5) Organic Chemistry; (6) Agricultural Bacteriology; (7) Agricultural and Physiological Botany; (8) Genetics; (9) Sugar Technology; (10) Agricultural Engineering and Physics. In addition to these professors, there should be appointed lecturers in the following two subjects: (1) Stock and Veterinary Science; (2) Book-keeping.

With regard to the curriculum of the proposed college, it is observed that the details concerning the instruction to be given to students should be settled by the Academic Board. Nevertheless, suggestions are made provisionally that there may be :—

(a) A junior course of instruction in tropical agriculture, extending over two, or possibly, three years. This course should be arranged to meet the requirements of youths leaving the secondary schools of the colonies who intend to follow ordinary agricultural pursuits, probably in the colony from which they come.

(b) A senior course of similar instruction, extending over not less than four years.

(c) A course of two years' instruction in more advanced tropical agriculture, for students who have undergone a course of instruction in general agriculture in a recognized institution, such as a university, a university college, or an agricultural college. This course would practically coincide with the final two years' teaching of the last-named course (b).

(d) Post-graduate study of special agricultural subjects in their tropical application, as, for example, Entomology, Mycology, Chemistry, Plant Breeding, and the general study of special crops, such as sugar, cacao, cotton, coco-nuts, rice, and a variety of others,

to be arranged to meet the requirements of the students. These studies would be carried on through the college, in association with the Imperial Department of Agriculture, through the medium of such local Agricultural Departments and Experiment Stations as appear to be particularly suited for them.

Special mention of the Sugar School is made as follows: 'Recognizing the urgent need which exists for the provision of scientific and technical training in sugar manufacture, the Committee strongly recommend that a Sugar School, equipped with a complete plant on a small but working scale, be established in connexion with the Tropical Agricultural College They believe that the leading sugar-manufacturing firms would be willing to contribute different portions of this plant.'

It may be remarked that the existence of such a school with its machinery and appliances, cannot fail to be stimulating in connexion with sugar manufacture generally. Not only should it provide means for giving general instruction in matters connected with sugar manufacture, but it should afford opportunities for investigations on points of importance to the industry. Many improvements would probably be the outcome of such investigations, while the introduction of new processes into British West Indian sugar factories should be greatly facilitated.

Referring to the recommendation that the Tropical Agricultural College should be closely associated with the Imperial Department of Agriculture, the Committee desired to emphasize most earnestly the importance of establishing that Department on a more permanent basis after the expiration of the present Imperial Grant.

With regard to financial arrangements, the Committee state that in approaching the question of ways and means, they have had constantly in view the fact that though the Tropical Agricultural College would be located in the West Indies, it would be to a great extent Imperial in its scope and activities, it being expected, for example, that the senior students would be post-graduates of British universities and colleges, and that many of the students trained in the college would be available for service throughout the Empire. Apart from this, they would point out that, as stated in an earlier paragraph of their report, it would be manifestly to the benefit of the Mother Country that production should be extended in the British West Indies on scientific and remunerative lines. They would emphasize, moreover, in this connexion, that of the American Agricultural Colleges in the tropics, that of Porto Rico, at any rate, is subsidised by the United States Government. In order to provide the requisite ways and means for the establishment and maintenance of the West Indian Tropical Agricultural College, the Committee recommend that:—

(1) For the establishment of the college a Fund of £50,000 and upwards should be raised by private subscription.

(2) For the maintenance of the college—

(*a*) Annual contributions should be invited from the various West Indian colonies on the basis of the equivalent of, say, ½ per cent. of their average revenue during the preceding three years, and each colony, in return for its contribution, should have the right to nominate a representative to sit on the Governing Body of the college and to enjoy special privileges in respect of its students; it being understood in this connexion that the constituent islands of the Windward Islands group should be regarded as one colony.

(*b*) Annual contributions should be invited from the Imperial Government as grants-in-aid, on the basis of £1 for every £1 contributed by the colonies, the liability of the Imperial Government, however, not to exceed £15,000 in one year.

(*c*) Voluntary contributions should be invited from industrial organizations and individuals interested in tropical industries.

The Committee feel very strongly that the claim for Imperial assistance would be fully justified by reason of the Imperial nature of the work to be undertaken.

These financial recommendations appear to be clearly put, and to be such as will meet the circumstances. Colonel Amery, however, in his despatch inviting the consideration of the Report, on behalf of Lord Milner, by the Governments of all the West Indian colonies, states that he feels serious difficulty about the proposal that the Imperial Government should be asked for financial assistance. He readily admits that the proposed college is of great impor-

tance to the United Kingdom and to the Empire at large. But there are many educational institutions in the United Kingdom which are similarly of importance to the colonies, though only in a very few cases do the colonies make any contribution to these institutions. The considerable measure of prosperity which many of the West Indian colonies are now enjoying further weakens the case for Imperial assistance. Should such Imperial assistance not be granted, it will evidently be necessary to raise the suggested rate of colonial contribution.

On the other hand, it may be remarked that from an Imperial point of view, the proposed college is calculated to give instruction and to enlarge knowledge in matters concerning tropical agriculture which relate to the whole Empire. The college is meant to train men, particularly specialists, in tropical agricultural subjects, for service far beyond the bounds of the West Indies. While the college is meant to be of great value and service to the West Indies, it ought also to prove of great benefit to the whole Empire.

THE EMPIRE COTTON GROWING COMMITTEE.

II.

As was stated in the article on the above subject which appeared in the previous issue of this Journal, the adequate development of the Empire's resources for the production of cotton appears to depend on the proper handling of three main questions. The first of these is the acquisition of necessary knowledge and the supply of men to apply that knowledge.

It is urged in the Committee's report that the foundation of all agricultural progress must be based on science, and that this is certainly true in regard to cotton. At present there is little accurate knowledge capable of being precisely stated of the different characteristics of the cotton fibre or lint, which contribute to the production of desired results in cotton yarns, or in the finished articles manufactured from them. Research is required in this direction. Apart, however, from this, research is needed also with regard to the actual growing of cotton. The essential characters of the cotton plant, and the modification of the lint brought about by various local conditions, require much further investigations. Two branches of research are required: the effects of heredity by which the constitution of the cotton plant is determined and can be controlled, and the effects of environment, such as the period for growth, climatic conditions, and soil characteristics. Bacterial, fungoid, and insect organisms affecting the growth of the plant are also among the subjects calling for further study.

With reference to the foregoing remarks of the Committee, it may be noticed that considerable and valuable work in these directions has been done, not only in Egypt and India, but also in the West Indies under the auspices of the Imperial Department of Agriculture.

To carry out the further research required, the Committee recommend that a Central Institute should be established to study the life of the cotton plant and the development of its lint from all possible points of view, except such as are of merely local interest and profit. It is suggested, for many reasons, that Egypt would be the most convenient place for such an Institute, provided the Egyptian Government would welcome the proposal. Such an institute would be linked up with the work at present being carried out by the Egyptian Cotton Board of Research, and also with local research work being done, or which may be done, in other cotton-growing areas, as for instance, the West Indies.

Whether such one centralized Research Institute, in Egypt, as recommended by the Committee, will meet all requirements, may be doubtful. It might be necessary to have other similar institutes in other countries where cotton is grown under conditions very different to those of Egypt, as for instance, India, and the West Indies.

With regard to the second part of the question—the supply of men to apply the knowledge—the Committee lay great stress on the need of great additions to the Agricultural Departments of practically every British colony and dependency. Everywhere, it is stated, more experiments, more demonstration, teaching and training of those who engage in cotton growing as a commercial industry are required. The Committee therefore put forward, as one of their principal recommendations, the importanee of strengthening the Agricultural Departments in all parts of the Empire, as vital to the general prosperity of the Colonial Empire of Great Britain.

The work of the British Cotton Growing Association since it was founded in 1904, is suitably acknowledged. Very little was then known as to the conditions under which cotton can be successfully cultivated. During the fifteen years which have since elapsed, much progress in this direction has been made. The British Cotton Growing Association has learnt by practical experience that there are large areas in which cotton cannot be grown commercially, but that there are others in which prospects are extremely favourable. It is pointed out, however, that pioneer work of this kind, that is, investigations as to the prospects for cotton in fresh districts, will be necessary for some time to come. For this purpose men will be needed in addition to those now employed in the regular Agricultural Departments of colonies and dependencies where cotton has become a recognized crop.

The supply of trained men to meet the requirements of staffs necessary for the adequate promotion of cotton growing is at present entirely insufficient. Three classes of men are required: highly trained men to conduct research work into principles; men of good scientific qualifications for the direct investigations in each locality; and practical men for pioneer work, and for bringing influence to bear on ordinary agriculturists. These classes are additional to administrative and executive officers, on whom will depend the enforcing of regulations necessary for the control of the industry. In view of the need of so many highly trained men, the Committee point out that provision ought to be made for more pure research to be done in British Universities in such subjects as plant physiology, plant genetics, mycology, and entomology, by founding Professorships or Readerships in each of these sciences. In addition, the recommendation is made that Studentships in these subjects should be available for post-graduate studies, by means of which promising men can be trained in methods of research. In this direction the Committee have made a small beginning, by having arranged with the British Cotton Industry Research Association to co-operate in offering five such Studentships to be held in the coming year.

SUGAR INDUSTRY.

THE UBA CANE IN INDIA AND NATAL.

Considering that the Uba cane is receiving increased attention in other cane growing countries besides Natal, where it has practically entirely supplanted other varieties, an article in the *International Sugar Journal*, January 1920, will be of general interest. The article is signed with the well-known initials of Dr. C. A. Barber. Extracts from the article are reproduced below.

It seems anomalous that a purely tropical crop like sugar-cane should have proved so successful in Natal, a country so far outside the tropics. The reason is undoubtedly owing to peculiar geographical conditions. The sugar tract in Natal is practically confined to the coast lands, and this part of the African coast is bathed by warm ocean currents, across which the trade winds blow on to the land. There is thus a sufficiency of moisture and warmth for sugar-cane to be grown wherever the soil is suitable. It is not usual, however, for thick tropical canes to be able in such latitudes to hold their own against those growing in more favourable regions. The average rainfall in the sugar tract of Natal is given as from 35 to 40 inches per annum, and it is not surprising that sugar cane thrives better in Portuguese East Africa, where the rainfall borders on 60 inches.

It seems that thick tropical canes do not thrive well in Natal, but that the Uba variety, a member of the great Pansahi group of Indian indigenous canes, has almost entirely supplanted them. Another variety of the same group, recently introduced from India, known as Agaul, appears to succeed even better. These two varieties in Natal are hardy, very resistant to insect and fungus attacks, can thrive both in heavy black soils and free hillside ones, and develop enormous tonnage—not infrequently reaching 60 tons per acre—yielding rich juice at harvest. At the highest yield it takes about 8 tons of Uba canes to produce 1 ton of sugar. The foregoing characters of the Uba cane as grown in Natal are somewhat surprising, when compared with the estimation in which the Uba is held in India, where it is not extensively grown. It belongs to a class of canes which have almost gone out of cultivation there, because of their liability to disease In India, their juice also, though comparatively abundant, is distinctly poorer in sucrose than any other local kinds, and much more so than when grown in Natal.

This marked difference in the behaviour and value of cane varieties of the same group in India and Natal is probably due to the difference existing in the conditions of growth in the two countries. In Northern India the cane-growing period does not usually last for more than six months in the year. Intense heat, coupled with severe drought, militates against rapid growth in the early stages, while extreme cold and diminishing moisture terminate the life of the plant towards harvest. In Natal, on the other hand, it is stated that the growing period required by Uba to reach its full maturity is twenty-two months. It is therefore quite possible that if this cane were reaped in Natal at from six to eight months after planting, it would be just as unsatisfactory as in India, both in quantity of cane and richness of juice. In Natal, with less extremes of temperature and moisture, it appears to be possible for the canes to grow throughout the year, although of course with varying rapidity. Furthermore, the same plants may grow on from year to year, in favourable conditions for as many as ten to twelve years continuously, producing paying crops of canes. Presumably the period of twenty-two months is determined by the comparative richness of the juice

The prosperity of the sugar industry in Natal probably leads to an amount of satisfaction with present conditions, but it might be well for sugar planters there to try and obtain a series of cane varieties from India, to form a reserve in case Uba cane should prove less satisfactory. It is quite in keeping with the history of the cultivation of cane elsewhere, that at some future period, sooner or later, the Uba may become subject to deterioration. There does not seem to be any reason why crosses should not be raised in Natal between varieties of the Pansahi group as one parent, and a thick tropical cane as the other.

In conclusion, it may not be without interest to append the following description of the Uba cane, as given by E. R. Gessner in the *South African Sugar Journal*, September 1919 : 'Cane somewhat thin, yellowish or greenish ; joints in well grown plants, up to 6 inches in length, but much shorter in unfavourable conditions or when nearing maturity ; very hardy, but containing much fibre ; difficult to crush, and requiring more powerful machinery than the thick cane ; a splendid ratooner, this being one of the factors in its extended growth ; leaves adhering firmly to the stem, and therefore requiring artificial trashing or burning (which is considered good practice) ; deep rooting, and adapting itself to the heaviest black, as well as to the shallow red soils of hillsides ; hardy, and resistant to insect and fungus attacks ; arrowing frequently, more so in red than black soil, but fertile seeds not yet obtained in Zululand or Natal.'

LOUISIANA SUGAR CROP FOR 1919.

The following data, contained in a report on the sugar crop of Louisiana for the year 1919, which appears in *Sugar* for December 1919, and showing also the gradual decrease in acreage annually from 1914 are interesting, in view of the present sugar shortage throughout the world.

The total acreage in sugar-cane grown in 1919, was estimated at 275,000 acres. In 1918 it was 303,000 acres.

The acreage in sugar cane cut for making sugar in 1919 was estimated at 176,500 acres. The acreage cut in 1918 was 231,000 acres ; two years previous, 244,000 acres ; three years previous, 221,000 acres, four years previous 183,000 acres ; and five years previous, 213,000 acres.

The acreage in sugar-cane cut for making syrup in 1919 was estimated at 20,800 acres.

The amount of sugar-cane reserved for seed, for the crop of 1920, is estimated to represent the growth of 77,700 acres.

The average yield of sugar-cane per acre for 1919 was estimated to be 10 tons. For 1918 it was 18 tons ; two years previous, 16 tons ; three years previous, 18 tons ; four years previous, 11 tons ; and for five years previous, 15 tons.

The average yield of syrup per ton of cane for 1919 was estimated to be 18·6 gallons; for the year before, it was 22 gallons, and two years previous, 22 gallons.

The quantity of sugar-cane used in 1919 in the manufacture of commercial and non-commercial syrup was

estimated at 208,000 tons. In 1918 the quantity was 494,000 tons, and two years previous, 257,000 tons.

The quantity of commercial and non-commercial syrup manufactured in 1919 was estimated at 3,874,000 gallons. The production in 1918 was 10,793,000 gallons; two years previous, 5,652,000 gallons; three years previous, 4,133,000 gallons; four years previous, 2,487,000 gallons; and five years previous it was 2,433,000 gallons

The quantity of sugar-cane used in 1919 in the manufacture of sugar was estimated at 1,765 000 tons. In 1918 it was 4,170,000 tons; two years previous, 3,813,000 tons; three years previous, 4,072,000 tons; four years previous, 2,018,000 tons; and five years previous it was 3,199,000 tons.

The quantity of sugar (all sugars) manufactured from the crop of 1919 was estimated at 115,589 short tons. The production from the crop of 1918 was 280,000 tons; two years previous it was 243,600 tons; three years previous, 303,900 tons; four years previous, 137,500 tons; and five years previous it was 242,703 tons.

LOSS OF SUGAR FROM FIELD TO MILL.

A paper read by E. T. Westley, at a meeting of the Hawaiian Chemists' Association in November 1919, gives the results of tests made in Hawaii of the sugar losses resulting from delay in grinding canes promptly after they are cut. The paper is reproduced in *Facts About Sugar*, February 21, 1920, from which the following paragraphs are taken.

Although most planters have always known that sugar is lost by delaying the milling of cane for any length of time after it is cut, the large amount that really is lost is certainly not generally realized.

There are several reasons why this loss has never received much attention. First of all, the field and the mills are entirely different departments, and one knows very little about what the other does. The field men are interested in getting the cane to the mill as easily and as cheaply as possible. They have very vague ideas about the chemical changes that take place in the cane after it is cut.

The mill men take it for granted that the cane is sent to the mill as fast as possible after it is cut. Most of the time they do not know if they are getting fresh or old cane. During the period a juice sample is taken (2-4-6 hours) both fresh and old cane may be ground.

On account of this, very small difference may be shown between the different daily samples.

To determine the losses, a couple of tests were made. Thirty sticks of uniform Yellow Caledonia cane were taken from a train at the scale. This cane was known to have been cut a couple of hours previously. The thirty sticks were divided into ten samples of three each. One sample was ground right away, twenty-four hours later another sample was ground, and so on.

To avoid errors the sampling was modified. In this test the cane was cut and brought to the mill by the laboratory force. Forty sticks were cut in a field within a circle of 15 feet diameter, and divided into ten samples. Each sample was then divided in two by cutting each stick in halves. Two top and two root sections were then taken from every sample. The ten halves of the original ten samples were ground in a hand mill, and the juice analyzed immediately. The other ten halves were weighed and spread out on the ground. Every day from then on one sample was taken, weighed and ground. In this way the sample ground on, say, the fifth day, was from exactly the same four sticks that were ground on the day the cane was cut.

From the above tests, and from tests conducted by the Experiment Station, the following tables have been constructed :—

LOSS IN WEIGHT, PER CENT.

Condition.	D. 1135.	Lahaina.	H. 109.	Y.C.
Fresh	0·0	0·0	0·0	0·0
2 days old	4.5	4·6	4·0	2·7
4 days old	8·1	8·7	7·4	4·0
6 days old	9·7	12·5	9·9	6·8

LOSS OF AVAILABLE SUGAR, PER CENT.

(As found by combining the weight losses and the decline in quality.)

Condition.	D. 1135.	Lahaina.	H.109.	Y.C.
Fresh	0·0	0 0	0·0	0·0
2 days old	8·8	5·7	2·8	3·2
4 days old	27·0	24·7	12·2	10·5
6 days old	34·7	41·4	18·0	15·7

The tables give the impression that Lahaina cane deteriorates faster than D. 1135, D. 1135 faster than H. 109, and Yellow Caledonia slower than the rest.

The losses given are really less than actual, as the same quality ratio formula that was used for fresh cane was also used for the old cane. It is obvious that the per cent. fibre would go up as the cane dried out. If the actual per cent. polarization of cane had been determined in all cases, higher losses would have been shown.

It is not only the loss that takes place before the cane reaches the mill, but the work in the mill and boiling house will be poorer with old than with fresh cane

From the tests so far conducted it must be taken as an established fact that there are very large losses in sugar when old cane is sent to the mill. It is fully realized that all the cane on a plantation can not be brought to the mill within twenty-four, or even forty-eight hours after it is cut, but it is believed that the percentage of cane thirty-six hours old and over can be considerably cut down.

The Experiment Station claims that the Hawaiian sugar crop could be increased by 30,000 tons of sugar if the cane were ground one day sooner after it is cut than it is at present. It is probable that this is a very conservative estimate

DEPARTMENT NEWS.

Sir Francis Watts, K.C.M.G., D.Sc., Imperial Commissioner of Agriculture for the West Indies, returned to Barbados on the R. M. S. 'Chaleur' on March 18, from a fortnight's visit to Antigua on official business.

Mr. H. A. Ballou, M.Sc., Entomologist on the staff of the Imperial Department of Agriculture, also returned to Barbados on R. M. S. 'Chaleur' on March 18, from a visit to Dominica and Antigua in connexion with entomological investigations.

Dr. S. C. Harland, D.Sc., Assistant for Cotton Research, attached to the staff of the Imperial Department of Agriculture, arrived at Barbados per R. M. S 'Chaudiere' on March 15, from St. Vincent, *en route* to England on leave. Dr. Harland expects to proceed to England by S.S. 'Arzilla' on or about March 22.

PRESERVING FODDER BY SELECTED FERMENTS.

Investigations by Corini in Italy, and a series of experiments outside Italy by others, confirm the theory on the utilization of selected ferments in ensilage. A summary of the discussions and investigations is reprinted in the *Agricultural Gazette* of Canada, January 1920. In view of efforts in the West Indies, notably Antigua and St. Lucia, in the erection of silos and the making of ensilage, the summary referred to above should prove of sufficient value to those interested, to merit reproduction in this Journal. As will be seen, preference is given to what is designated the 'lactic' silo:—

These studies were begun in 1904 during the scientific debate between those holding the bacterial theory and those holding the physiological or autolytic theory of the transformation factors occurring during ensliage. Leaving aside the thoretical aspect of the problem, the studies showed :—

(1) Bacterial intervention, considered not indispensable by some, is constant and unavoidable in practice.

(2) Successful ensilage is closely connected with the bacterial conditions of the silo.

(3) Consequently, bacterial intervention cannot be considered negligible (as in the case of the autolytic theory), and may be advantageous or injurious according to the nature of the predominating bacterial flora.

(4) The bacterial flora of normal silos is comparable to that of cheese, and, taking the nature of the predominating bacterial flora as a basis, silos may be classed as *lactic* or *butyric* rather than *sweet* or *acid*, as they differ far more in their volatile acid content than in their degree of acidity.

(5) Preference should be given to the lactic silo from the point of view of economics, the cheese industry, and hygiene, as well as from that of cattle feeding and the milk supply, especially for children and invalids.

These results give a new turn to the preparation of ensilage, reducing it to a process of preservation by lactic fermentation, such as frequently occurs in nature. In ensilage, therefore, it is necessary that the lactic bacterial flora should predominate as rapidly as possible. This is not always easy, and depends on many complex conditions, the realization of which is inhibited by many natural causes (variations in weather conditions, quality of the fodder, etc.) or technical causes (construction of the silo, method of filling and compression,etc.); it depends, above all, upon the presence of lactic ferments sufficiently numerous and virulent to predominate rapidly over antagonistic bacteria. Maize, for example, is very suitable for ensilage because it is the material richest in lactic ferments ; herbaceous material is less suitable for ensilage because it is often relatively poor in lactic ferments. Silos, insufficiently or overheated, are the most dangerous because too low a temperature does not favour the development of the lactic ferments, and too high a temperature prevents the development.

To make up for the shortage of the necessary bacterial flora due to defective natural or technical conditions favouring spontaneous lactic fermentation, the proposed addition of selected ferments is useful and often necessary, hastening the fermentation process, and greatly attenuating the difficulties described, especially that arising from the degree of heating of the ensilage. Strong lactic ferments allow the ensilage to reach a fairly high temperature (about 50° C.), even though it be for a short time only, thus causing a more active and a purer lactic fermentation, free from volatile and secondary products.

These theories are confirmed by numerous works published outside Italy, and agree perfectly with the accepted electric autolytic-bacterial doctrine. Moreover, the use of selected farms is also in accordance with pure autolytic theory. Even when bacterial life is considered to be excluded it still exists inevitably, and the use of ferments helps greatly, by the strong acidification caused, to remove all other bacterial activity. If maize silage, on which the physiological theory is based, gives results at all temperatures, it is because it lends itself best to rapid lactic fermentation caused by the numerous lactic bacteria present.

The results obtained by the author and other workers seem to show the work to be sufficiently advanced to prove the value of selected ferments in ensillage to be equal to that assigned them in cheese-making. The present shortage of fodder makes it necessary to utilize everything of value as a food by easy and cheap methods of preservation at all seasons. The author, therefore, proposes, without giving up systematic experiments, that an abundant supply of selected ferments should be distributed among the travelling chairs of agriculture and farmers. All necessary precautions must, of course, be observed, instructions given as to the best methods of using the ferments, and the bacteriological and chemical control necessary to assure the best results exercised. This would prove a good, simple, and practical method of propaganda for ensilage, as the method requires no special installation nor rigorous rules as to the temperature of fermentation, which may vary within fairly wide limits (from 30 to 50° C.). Whatever the transformation factors of silaged fodder may be, the addition of lactic ferments will in all cases perfect the process, giving economic and hygienic advantages to animal production, the cheese industry, and the milk supply,

AGRICULTURE IN BARBADOS.

During the past fortnight grinding has been started on many estates, but there is not as yet a general beginning. In a few cases machinery is not ready : in others, the unripe condition of the canes coupled with the endeavour to finish up the manuring and tillage of the young crop is the cause.

It is perhaps too soon to say definitely that the return will be much behind appearances, but the various reports we have received point in this direction. In Christ Church, St. John and St. Philip, the average tonnage of cane to the acre is 22, with a density of 9°. Some ratoons which have been cut in the red soil have yielded only 8 tons.

Here and there we have heard of a density of 10° where the B.H.10 (12) is being reaped. This cane, as stated in our last report, is showing up well in the red soil, but it seems to find its most suitable habit in St. Andrew and in the heavy districts of St. Joseph. We gather that from one field at Freizers this season, it has yielded as high as 40 tons per acre as a plant cane. Where this seedling is heavily manured it will also excel as a ratooner even under adverse circumstances, such as undue delay in reaping. It also seems to resist the root borer better than the B.6450. In this respect we would speak highly of the Ba.6032. The

fields of this seedling, as far as we have been able to judge, are in a most healthy condition, and should, when the best fields are cut, give a fairly satisfactory yield

We are sure that on many estates reaping will be leisurely done until well into March so as to give the canes a chance of reaching a higher state of maturity. After that, the usual 'speeding up' will be done.

We have not hitherto made reference to the improvements in the factories for this season's grinding. These improvements have been general and varied, and we do not think the expenditure has been much under a quarter of a million sterling. This large sum is money well spent, both because of the extra return that will be insured through more efficient milling and manufacture, and because of the circulation of the money thus spent.

The young cane crop is making very satisfactory progress. Both in the red and in the black soil there are very forward fields to be seen with clusters of healthy shoots growing apace.

The yam crop which has practically been reaped, has been, as we anticipated, a very moderate one. Eddoes, and particularly white eddoes, have yielded a fair return. Of these, there are still some fields now to be taken in, owing to the late start which they made in the dry weather of last year.

Potatoes are scarce in some districts, but we think there is a larger number of fields of this vegetable now on hand than was the case at this date last year. It is very necessary that both peasants and planters should do all in their power to plant ground provisions and to induce good returns by good tillage and also, if possible, by the manuring of the fields so planted. (The Barbados *Agricultural Reporter*, March 6, 1920.)

SOIL IMPROVEMENT FOR MAIZE.

In a previous number of this volume of the *Agricultural News* (No. 465), the editorial discussed the question of increased local corn production, in view of the prevailing high rates of exchange and their effect on the cost of corn imported into the West Indian colonies for local consumption. The objections entertained by West Indian planters to more extensive cultivation and the intercropping of corn with cane, were referred to, as also the exhausting effects of a corn crop on the soil constituents, rendering subsequent additional fertilization of the land necessary.

In connexion with the question of soil exhaustion, reference might usefully be made to means suggested for replacing the soil constitutents removed from the soil by a crop of corn, and effecting soil improvement for maize generally. The improvement of the soil for maize-growing is a question that is yearly becoming of more importance in agricultural communities, more especially those devoted chiefly to farming. The subject is recently discussed in an article published in the *Agricultural Gazette* of New South Wales, where the loss of organic matter and plant food is emphasized, and the means of restoring these indicated. It is pointed out that cultivated crops like maize, root crops, etc., which are grown in drills, consume organic matter more quickly than wheat and broadcast crops which are not cultivated, due to soil aeration. In addition to the loss of organic matter, a crop of maize (corn) removes from the soil larger amounts than most other crops of the chief materials of plant food—nitrogen, phosphoric acid, and potash.

The three chief means suggested for restoring or making good these losses of organic matter and plant food are, (1) rotation of crops; (2) cover cropping and green manuring; and (3) the application of manures and fertilizers. The advantages of having a good supply of organic matter in the soil for maize growing, are in brief, all the advantages of a virgin soil over an old and long-cultivated one. The organic matter—which as has been frequently stated in previous numbers of this Journal—may consist of any form of animal or vegetable matter—aerates the soil and opens it to the better ingress of rain, enables it to retain that moisture for a long time, largely prevents cracking and baking, and checks the leaching of soluble plant food materlal—especially nitrates. It also prevents, in part, the washing of soil on a hill slope, helps to render insoluble plant food material available, and itself supplies this material in a form readily assimilable by plants.

Other things being equal, the greater the amount of organic matter in the soil, the richer is the soil in nitrogen, which is the most expensive element of plant food, and which is removed from the soil by the maize crop in largest quantity.

Stable or animal manure is the most valuable form of organic manure readily procurable in most places. Apart from the organic matter which is supplied in animal manure, it contains appreciable amounts of nitrogen and potash, which are at all times (and especially so at present) the most costly elements purchased in fertilizers.

The average amounts of the three chief fertilizing elements in one ton of the solid fresh manures of different animals are given as follows:—

Animal.	Nitrogen.	Phosphoric acid.	Potash.
	lb.	lb.	lb.
Horse (without litter)	10	6	8
" (with litter)	12	5	12
Cow ...	8	4	6
Pig ...	12	9	6
Sheep ...	12	9	9
Poultry ...	15	15	10

Particular attention is directed to the virtues of horse, cow, and pig manure, and to the part it can be made to play in the production of immediate and lasting increased yields of maize. The large amount of organic matter in animal manure, as already indicated, contributes much to its value, particularly for the maize crop. It is now known, too, that maize is one of the few crops which can make use of organic nitrogen and ammonia compounds directly as plant food, without waiting for their entire conversion into nitrates.

It would appear from the foregoing that, given an adequate supply of stable or animal manure, which may be taken to include all forms of animal excreta, there is no insuperable objection to the extensive cultivation of Indian corn as a catch crop with sugar-cane in the sugar-producing colonies of these West Indies, with a view to increasing the local supply, and reducing the large and costly importations of this foodstuff.

The production of sugar in the Union of South Africa is continuing to expand. The *Chamber of Commerce Journal*, January 9, 1920, states that during the sugar year ended April 30, 1919, all previous crop records were surpassed, the production reaching 150,000 tons of marketable sugar, valued at about £3,000,000. From the 1919-20 crop, an output of 160,000 to 170,000 tons is anticipated.

EDITORIAL NOTICES.

Head Office — Barbados.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on page 4 of the cover.

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†Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial continues a review of the Report of the Committee on a Tropical Agricultural College in the British West Indies, the first part of which appeared in the previous number of this Journal.

Under Plant Diseases, on page 94, the article dealing with the Panama disease of bananas is concluded

On page 83 a continuation of the article on the Empire Cotton Growing Committee will be found.

Insect Notes, on page 90, contain two short articles, one on the control of the mole cricket, and the other on some habits of cotton stainers.

Candling Eggs.

By the term 'candling' is meant a method for sorting out bad eggs from good ones by holding each egg before a strong light, in such a manner that the rays of the light come to the eye through the egg, so that the condition of the egg's contents can be seen. After a new laid egg has been handled, or exposed to the air even for a short time, it becomes difficult to tell whether it is a fresh or an old one from the appearance of the shell. By resorting to 'candling' the point is definitely settled. In *Department Circular* 15, United States Department of Agriculture, Bureau of Animal Industry, clear instructions are given whereby this process may be employed by anyone.

Eggs can be candled best in a dark room, using a bright light enclosed in a box or case having a hole, a trifle smaller than an egg, directly opposite the light. At this hole the egg is held for examination. An ordinary hand lamp, a lantern, an incandescent bulb, or a flashlight may be used. Any box set on end that is large enough to hold the lamp will do. In addition to the hole opposite the light, there should be a hole at the top end of the box, otherwise the heat from the top of the chimney would set the box on fire. Hold the eggs, one by one, large end up, close to the light.

A perfectly good fresh egg shows 'full' and 'clear' before the light. There is almost no air cell at the large end, and the yolk outline is only faintly visible. A fixed air cell of one-eighth to three-sixteenth inch in depth indicates a fresh egg, as eggs run generally. A larger air cell, with a movable lower line, indicates—according to sizes and fluctuations—a stale egg, or one becoming weak and watery.

Very small dark spots, which sometimes may be seen, are usually blood clots. Large, dark spots, blood rings, and shadows are due to heat and germination, and indicate the first stages of decay. An egg that looks very dark and black, except for a large fixed air cell, contains a chick at an advanced stage of incubation. An egg which looks dark when tested in the same way, but shows a large air cel with a movable lower line, is usually in an advanced stage of fluid decomposition, or what is commonly known as a 'rotten egg.'

As will be seen by the above directions, with a little practice it becomes a very simple matter to test eggs in this way.

The Queensland Walnut.

There are comparatively very few trees grown in the West Indies which bear really good edible nuts. In fact, with the exception of the cashew (*Anacardium occidentale*), and the bread-nut (*Artocarpus incisa*, var. *nucifera*) the only other tree common in the smaller islands at least, the kernels of which are worth eating, is the so-called ' almond ' (*Terminal Catappa*),

An extension in the planting of other tropical nut-bearing trees would seem advisable.

This subject has been suggested by a note in the *Inventory of Seeds and Plants Imported*, issued by the Bureau of Plant Industry of the United States Department of Agriculture, September 6, 1919, which draws attention to the successful cultivation of one such species introduced into Hawaii. This tree (*Macadamia ternifolia*) is a native of tropical Australia, and is known as the Queensland walnut. The following description is taken from the note referred to above :—

'The trees were introduced into Hawaii from either Queensland or New South Wales about thirty years ago. The nuts on these trees ripen almost throughout the year. Plants are readily grown from the nuts, and younger trees begin to bear eight years from planting. The leaves of the tree, which seldom attains a height of more than 30 feet in the Hawaiian Islands, are dark green and very shiny. The nuts are roasted in the same manner as salted almonds, and are used in the same way. They are crisp and tender, and in some persons' opinion, are more delicious than salted almonds.'

In the Report on the Agricultural Department, Dominica, 1914-15, it is noted that seeds of this tree had been received from Trinidad for planting in the Botanic Garden. It is too soon for results to have been obtained in Dominica, but it is evident that there are specimens of the tree fruiting in Trinidad. More extended experiments might be well worth making in other islands.

Cacao Production.

In an article which appears in *Tropical Life*, December 1919, dealing with the question of the problem which the cacao planter has to face in endeavouring to increase the amount of cacao produced, either per tree or per acre, attention is drawn to the fact that only a fractional percentage of fruits reach maturity, when compared with the thousands of flowers borne by each cacao tree : van Hall considers that 'on full-grown trees (ten years and older) the number of blossoms produced is very great, but only $\frac{1}{4}$ to $\frac{1}{2}$ per cent.—one out of every 200 to 400—develop into fruit.'

The question arises whether anything can be done to check this apparent waste of flowers. A suggestion is made that, as in the case of vanilla, the flowers on the cacao tree might be artificially pollinated with a camel's hair brush. This seems to be quite possible, and would probably result in the production of more pods per tree. On the other hand, it must be distinctly remembered that, like other fruit-bearing trees, the production of a very heavy crop of fruit would probably tend to some loss of vigour in the cacao tree, which might lead to a diminished yield in the following crop, and would certainly necessitate supplying additional plant food to the soil of the cacao orchards.

A Famous Old Tree.

The original Algaroba tree (*Prosopis juliflora*), a tree of historic interest, which had been planted in December 1828 in the Mission grounds in Honolulu, after having stood for ninety-one years, although it had been reduced to a very weakened condition, was removed on October 23, 1919, to the sorrow, says an article in the *Hawiian Forester and Agriculturist*, December 1919, of all sympathetic residents in Honolulu.

Perhaps no other tree in the world has been responsible for greater benefits to the land of its adoption than this original algaroba, for from it, by the assistance of live stock, there have been established on the lee shores throughout the Hawiian Islands, forests which now cover approximately 90,000 acres of what used to be barren lands, but which now produce an annual crop of about 30,000 tons of excellent fuel. Besides this, the trees produce an enormous yield of beans, which furnish a valuable fattening food for stock after the long dry summer has exhausted the supply of grass. In addition, the flowers of these forests afford food for bees in numerous apiaries, producing honey to the value of more than $160,000.

On account of the economic position which it holds in the islands' flora, the algaroba tree may be considered to-day as the most valuable tree in Hawaii.

A New Smokeless Fuel.

The *Louisiana Planter*, February 7, 1920, draws attention to the invention of a process whereby a smokeless fuel is to be manufactured from many carbon wastes.

It seems that in the year 1918, the British Admiralty offered a reward for some device by which fuel oil and coal tar—an enormous residue from England's gas industry—might be utilized for the production of heat. The Submarine Defence Association included this problem in their researches, and produced a fuel composed of 45 per cent. petroleum, 20 per cent. coal tar, and 35 per cent. pulverized coal, thus reducing by 55 per cent. the amount of oil used under boilers.

Charcoal, coke, hard pitch, the coke-like residues of petroleum refineries, and a graphitic anthracite can be reduced to powder and mixed with oil, so that the resultant liquid will be richer in heat units, volume for volume, than a corresponding quantity of unmixed petroleum, and much higher in heat value than an equal bulk of the best grade of coal.

This liquid fuel will possess, it is stated, 25 per cent. more heat units than an equal quantity of oil, and will occupy only two-thirds of the space required by coal. The new fuel burns without ashes, and furthermore, it does not, like crube petroleum, exhale inflammable gases; it is immune to spontaneous combustion, its flash point being well above 240° F. It can also be fire-proofed by pouring upon its container an inch of water. If by chance it takes fire, it can be extinguished by water as well as by sand.

INSECT NOTES

THE CONTROL OF CHANGA OR MOLE CRICKET.

The following note on the control of mole crickets in St. Lucia appears in the recently issued Report on the Agricultural Department of that island, and is here reproduced as of general interest:—

The mole cricket (*Scapteriscus didactylus*) is common throughout this island. During the dry season it does not appear to be as active as during the wet period. I am of opinion that the ground being harder during the dry season, it is not possible for the mole crickets to make rapid headway.

Our experience has been that whenever a patch in a grass lawn or road becomes extra moist, either through a depression in the soil, or for want of drains, these patches quickly become a starting point for the attacks, and I have known them to spread a distance of over 600 feet in a few weeks from such small patches.

The mole cricket has always been a pest in vegetable gardens throughout the island, and at various periods it has caused a good deal of injury to grass tennis lawns and cricket grounds It has been a serious pest at the Experiment Station, Réunion, where it has entirely destroyed the new grass roads. Some of these roads, 15 feet wide and 600 feet long, have been totally denuded of grass, and the soil worked up to a loose line tilth to a depth of 3 inches.

It is interesting to record that the mole cricket appears to be incapable of destroying really hard turf top dressed with a heavy layer of 'tiff.' One of the grass sections that had been destroyed was turfed with solid turfs of lawn grass dressed with fine 'tiff,' and rolled in, and although this was done twelve months ago, and without any previous treatment of the infested soil, no sign of the mole cricket has appeared. These walks were originally made by levelling the surface, and rolling; then allowing the grass to appear naturally. In some spots, where the grass did not spring up readily, turfs were inserted, and in every instance these have not been destroyed or injured, although the whole of the roads were otherwise destroyed. The grass in each case was the Bermuda grass (*Cynodon dactylon*). This tends to show that, once the roads or lawns are properly established, the mole cricket does not make any great progress in the mass of fibrous roots of the grass, and the layer of surface 'tiff' appears to afford some protection.

Where this pest occurs in small patches in lawns, it is easily checked by watering with whale-oil soap solution (1 lb. to 5 gallons of water). Large numbers of mole crickets may be brought to the surface in this way, when they can be collected. The advantage of this remedy is that it is not necessary to fork the lawn before applying the solution.

HABITS OF THE COTTON STAINER.

In the interesting portion of the Report on the Agricultural Department, St. Vincent, for the year 1918-19, which deals with special entomological and mycological investigations, the life-history and control of the cotton stainer is dealt with. Much of this has already been reproduced in the *Agricultural News*, May 17, 1919. The following additional note seems worth reproducing also.

Mr. W. N. Sands endeavoured to ascertain the length of time adult cotton stainers could survive under natural conditions, and in the absence of regular malvaceous food-plants. Observations were made chiefly in the Botanic Gardens and the Experiment Station. These indicated that the insect could exist without breeding for at least three months, merely by sipping the nectar of flowers, honey-dew, and water, and by remaining in cool, shady places. It is this fact that renders the absolute control of the pest so difficult. The observations suggest also that the close season for cotton should be made as long as possible, and that the destruction of native food-plants should be continued systematical ly

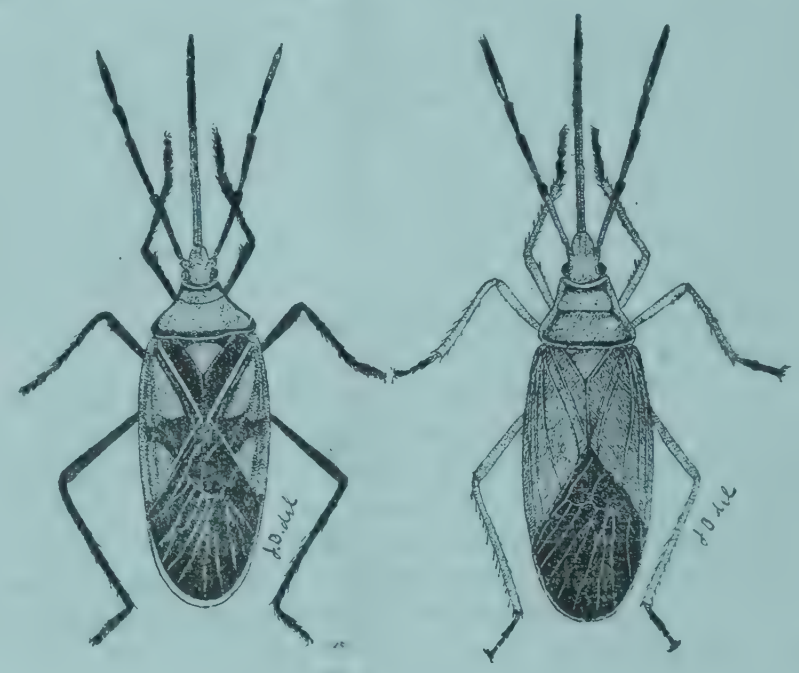


Fig. 3. Cotton stainer. *Three times natural size.*
To the right, *Dysdercus delauneyi*, found in the Southern Islands.
To the left, *Dysdercus andreae*, found in the Northern Islands.

The experience of the past two seasons has shown that cotton planted in May always attracted the surviving insects, and it was in this that they first started to breed; and further, that in districts where later plantings were made, the pest did not become numerous until the bulk of the cotton had been reaped, and therefore beyond the possibility of damage.

As an example of the attractive powers of a food-plant in the close season, it may be of interest to note, that a group of Tobago bred-nut trees (*Pachira aquatica*) were allowed to remain in the Government House grounds as a trap for the insects. The trees were in full fruit in the month of April, or just after the cotton stalks had been destroyed. On April 26 large numbers of cotton stainers started to arrive from the cotton fields. A number of cotton seed traps were placed in heaps at the bases of the trees, and all the Tobago bread-nut fruit and seeds were collected as they fell to the ground.

It was known from previons trapping experiments, that the pests would leave the Tobago bread-nut for the cotton seed, and this they did. From April 26 to June 15 the traps were burnt over twice daily with a kerosene torch, and on each occasion thousands of adult insects which had been attracted daily to the trees in search of food were destroyed. The result of this work was that the pest in the district was practically exterminated.

CACAO PRODUCTION IN DOMINICA.

Mr. Joseph Jones, Curator of the Botanic Gardens, and Agricultural Superintendent, Dominica, has forwarded some interesting notes on the subject of the production of cacao in that island, which are reproduced in the following paragraphs :—

The position in regard to cacao cultivation in Dominica is a difficult one to discuss, as it has been impossible in the past to arrive at even an approximate estimate of production, on account of the fact that a large amount of cacao is known to leave the island without the knowledge of the Customs.

Owing to the losses and injury to cacao trees caused by the hurricanes of 1915 and 1916, and the considerable amount of cacao which was smuggled out of the island on account of a large demand at high prices in neighbouring foreign islands, the exports of this product recorded by the Customs fell to a low figure during the past three years, as the following table shows:—

	Cacao.
1917	3,169 cwt.
1918	4,239 „
1919 Jan. to Nov.—11 months	3,214 „

With the coming in of the Christmas crop of 1919, conditions underwent a great change. The price of cacao in the mean time had gone up to a high figure in London, a local demand sprung up for all estate cacao of the right standard at good rates, and peasants' cacao was also eagerly taken up at better prices than those hitherto obtained.

This condition of affairs, coupled with falling money values in the neighbouring foreign islands, made, for the time being, the smuggling of cacao unremunerative, except that amount which goes on, and probably will always go on, in exchange for certain commodities ; and, for the first time possibly in the history of cacao cultivation in Dominica, the bulk of the Christmas crop was attracted to Roseau for open sale and legitimate shipment.

The results are interesting. During December 1919, and January 1920, a period of two months, the shipment of cacao from Roseau amounted to 6,260 cwt., or nearly twice as much as that exported during the whole of 1917, and very considerably in excess of total shipments during 1918.

During the first eleven months of 1919 the amount of cacao exported was 3,214 cwt. During the month of December of that year, it was 4,173 cwt. If present conditions continue for a year, and the Roseau market attracts the cacao crop as at present, it will be possible for the first time to obtain some true idea of the extent of cacao production in Dominica. If these conditions show the output to be greater than is generally supposed, it would appear that the surreptitious shipments of cacao from the island have been on a greater scale than had been imagined.

It is necessary in discussing this question to point out that the Christmas crop for 1919 was the first generally good one since 1916, and marks a return to pre-hurricane conditions as regards yields. But it is doubtful if the losses on estates in 1916, which amounted to over 10,000 trees, and the further losses in peasants' cultivation, which were probably greater than those experienced by planters, have been made good by new plantings during recent years. It is unfortunate that since 1916 very little has been done in the direction of development work on estates.

The shipment of over 6,000 cwt. of cacao, of a local value of about £30,000, within a period of two months, must impress all interested in the welfare of Dominica with the importance of even a small cacao industry. Further, it shows how necessary it is both for planter and peasant to do all that is possible to improve the position in this respect. Twenty-five years ago, when the knowledge of local conditions as regards cacao cultivation was meagre, many mistakes were made. To-day no expensive and pre-doomed experiments need be attempted in growing delicate and high class varieties for which our climate is unsuited, nor need the mistake of planting cacao at high altitudes or in very wet districts be repeated. Wherever there is suitable land in the coastal districts, it would appear to be a wiser policy to plant hardy varieties of cacao than to grow limes, especially when it is remembered that, when once established, a cacao plantation can be run with a smaller labour-supply than a lime plantation, and that the preparation of cacao beans for market involves, on small plantations, no very expensive outlay, and that such as is necessary is usually obtainable within the resources of comparatively small growers.

THE TEMPERATURES OF SMALL FRUITS WHEN PICKED.

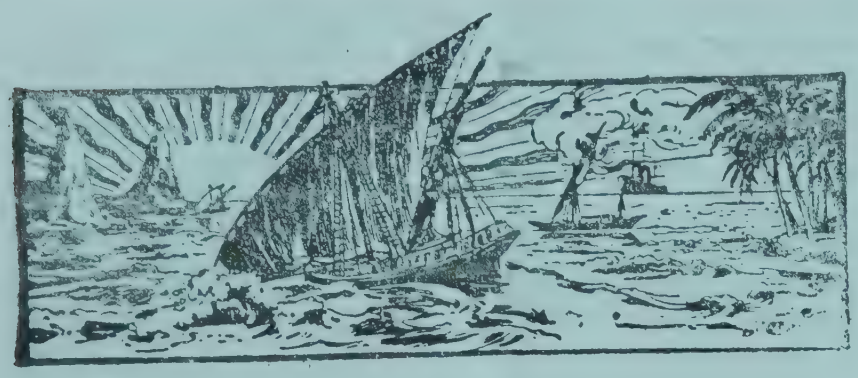
Data obtained from experimentation in connexion with the temperatures attained by some fruit at certain times of the day, in addition to their botanical significance, would seem also to be of practical interest with respect to the keeping qualities of the fruit. They appear too to indicate the proper time of day when certain fruit intended for market should be harvested, so as to ensure minimum decay during transport, and on the market. The following note on the subject is reproduced from the *Agricultural Gazette* of Canada, for January 1920 :—

Current literature does not seem to contain any reference to the fact, easy to observe, that small fruit on clear days attain a temperature much higher than that of the air ; this is probably due to isolation. Besides their botanical interest the data obtained are also of practical interest with respect to the decay of the fruit during transport, and on the market.

It was shown that small fruit, especially strawberries, keep better when picked cold rather than warm (i.e. in the afternoon). Already in 1903 Mr. Powell (Bureau of Plant Industry *Bulletin No. 40*, 1903) observed that peaches picked and packed towards afternoon are warmer, and reach the market in less good condition than fruit picked in the morning, though he did not note that, towards midday the temperature of the fruit is above that of the air. Fruit was collected and put in a quart basket, and a thermometer placed in the fruit mass, near the centre of the basket. The temperature thus observed was that of the outside surface of the fruit and the air circulating amongst it. The temperature was read at intervals of one hour from 6 a.m. to 7 p.m.

The greatest difference found between the temperature of the air and that of the fruit was: strawberries, 9·5 C. at midday; green gooseberries, 4·5 at 10 a.m.; currants, 8·5 at midday; cranberries, 6·5 at 10 a.m.

The rise in temperature of the fruit is chiefly due to the absorption of radient energy. As a rule the difference between the temperature of the fruit and that of the air was greatest when the sun was highest, lowest in the morning and afternoon, and practically nil at night and on cloudy days.



GLEANINGS.

According to *Facts About Sugar*, February 21, 1920, the British Royal Commission, after being out of the market for some time owing to the prevailing high prices, had again become a buyer of Cuban sugar, purchases on its account being estimated at 75,000 to 100,000 tons, at prices ranging from 10c. to 9c., f.o b.

The Egyptain crop of cotton, which used to be worth about £30,000,000 before the war, has risen to the value of about £130,000,000 for the present season. It seems that, apart from an unexpected crop in the next year in the United States, the prices of cotton must remain high for several years, especially considering the enormous demand for cotton goods throughout the world. (*Bulletin de L'Association des Planteurs de Caoutchouc*, December 1919.)

The evidence adduced by the late Sir Hermann Weber, in his book on longevity, seems strong enough to support his claim that great moderation in eating and drinking, and plenty of open air exercise can promote the duration of life of the middle aged to a marked extent. The degeneration of the blood vessels and other organs, which hastens the end of life, is primarily due to toxins absorbed from the bowels, or from infections. A clean, healthy life keeps these away. (*Nature*, January 22, 1920.)

In contrast to the primitive agriculture of most of Macedonia is that of a few districts, notably that of the Struma plain, where land has been acquired by enterprising Greeks with capital. Shortly before the war, cotton cultivation had been greatly improved by some of the bigger farmers of this plain, and, in spite of the considerable damage that the cultivation has suffered, the crop will no doubt soon become one of the chief sources of revenue to the region. (The *Geographical Journal*, January 1920.)

In *Proceedings of the Agricultural Society of Trinidad and Tobago*, December 1919, it is stated that, with the exception of sugar, the production for 1919 in the colony had been beyond the average quantity, while the loss resulting from any shortage had been more than compensated for by the generous prices ruling for the principal staples; and planters have good reason on the whole to be satisfied. Whether they are so is another matter, for the satisfied planter of the West Indies, like his prototype the farmer of the old countries, is not easy to be found.

The Secretary of State for the Colonies has appointed a Committee to consider whether the staffs of the Veterinary Departments in the various Colonies and Dependencies are adequate; and, if necessary, to recommend increases of staffs; to consider whether the rates of salary offered to the veterinary staffs are adequate; and, if necessary, to suggest improvements; and to make recommendations for improving the arrangements for recruiting veterinary staffs for the Colonies and Protectorates. (*Nature*, February 5, 1920.)

During the past year, approximately 500 acres have been put under cotton in Swaziland, and the crop on the whole has been excellent. Experiments with many varieties have been carried out, but it has not yet been definitely established which variety is most suitable for the country. It is reported, however, that Swaziland is essentially a cotton-producing country of the future. The rainfall, from 30 to 40 inches average per annum, absence of frost except along some of the streams, abundance of sunshine, and fertile soil supply the requisites for successful cotton production. (*Colonial Reports*—Annual, No. 1020.)

There seems to be some ground for the belief that the Southern Dominions have entered upon a cycle of dry years. For some years past large portions of Australia have had an unusually small rainfall, and this summer the drought has been very severe in the wheat-growing and pastoral regions of the interior. South Africa has also experienced drought conditions this summer, and even New Zealand, where the rainfall is normally as steady as that of the British Isles, has experienced a deficiency of rain sufficient to reduce the yield of milk, and consequently this season's production of butter and cheese. (The *Times* Trade Supplement, January 31, 1920.)

The Annual Report of the Department of Agriculture, Western Australia, for the year ended June 30, 1919, states that few people have any idea of the rate at which rabbits—that Australian plague—increase. Rabbits breed, on an average, nine times a year, and average six young ones at a birth. The progeny therefore of two rabbits, left undisturbed and allowed to breed at this rate, considering that their first litter would also begin to breed at four months old, would amount at the end of the third year to 13,718,000. If, as some say, the does do not breed until five months old, the progeny at the end of three years would be 3,272,000. It seems incredible, but these figures of course make no allowance for deaths from accident or other causes; still they show the necessity of dealing vigorously with this agricultural pest.

The food accessory bodies, known now as vitamines, are realized to be of greatest importance to growth, health, and resistance to disease, the lack of them making the body susceptible to the rank growth of pathogenic microbes. Professor McCollum, in a recent book reviewed in *Nature*, January 22, 1920, lays the greatest stress on the 'fat soluble A' accessory body, which is of supreme importance for growth, and is to be found in milk, eggs, and the germ of grains. Dairy produce from cows fed on green leaves, and green leaves themselves supply fat soluble A, and are thus the great protective foods, and every endeavour must be made to keep up the supply of these. Green vegetables are not to be considered as a luxury, but as a most essential part of the diet.

ST. LUCIA: REPORT ON THE AGRICULTURAL DEPARTMENT, 1918-19.

The Report under review constitutes an interesting record of good work done by the officers of the Agricultural Department in many directions, and testifies to distinct agricultural progress in the island.

Sugar and its by-products take the first place in value of agricultural produce exported from the colony. Although the production in the year reported on was about £1,000 less than that of the previous year, principally owing to the difficulty of obtaining sufficient supplies of fertilizers, the actual value of the sugar exported was £1,700 more than the previous year. This, of course, was due to the much higher prices obtained.

A very substantial increase has been made in the cacao industry. Cacao cultivation has received considerable attention during the last few years, both by planters and by the officers of the Agricultural Department. The areas under this crop have not been greatly extended, but much good work has been done in bringing the older plantations into a more healthy and productive condition. Draining and the free application of lime to the soil have given excellent results, and increased the crop in many instances. Mulching combined with reduction of overhead shade and judicious pruning has also helped to increase the productiveness of the trees. Peasant holdings have been regularly visited by the Agricultural Officers, and much has been accomplished in controlling diseases, and bringing the trees into a more vigorous condition.

Considerable progress has also been made in the lime industry. Lime products of the value of £14,261 were exported during the year, being very nearly double the value of those exported during the previous year. The green lime trade suffered a temporary check, through the New York market being closed on account of the shipping restrictions. These restrictions have now been removed, and there is no doubt that St. Lucia will soon occupy a prominent position in this industry, as her shipping marks have become well known in the New York market, where they stand for high grade fruit, carefully packed, and in sound condition.

The other chief agricultural industry, namely, coco-nuts, seems to have fairly maintained its position, although not much extension is observable.

The high price prevailing for honey has proved a strong stimulus to the local bee-keepers, with the result that this industry now occupies the premier position of the minor industries of the colony.

Bee keeping as an industry commenced in St. Lucia in 1902, and notwithstanding the fluctuations in market prices, and the variations due to good and bad seasons, the industry has been carefully nursed, and now that the demand for honey has increased, and the prices realized have exceeded all expectations, the industry is rapidly extending The island is particularly free from disease; foul brood and other serious bee diseases do not exist.

Every assistance has been rendered to the Bay oil industry by the Government, and the Agricultural Department realizes that a prosperous peasant industry can be developed. With an abundant supply of wild and semi-wild bay leaves, there is no reason why a permanent industry in bay oil and bay rum should not be established.

With regard to agricultural education in Primary Schools, the Examiner's Report gives clear indication that the standard of instruction, as well as the progress of the pupils is improving. The scheme which has been approved of by the Government for the training of agricultural cades under the supervision of the Superintendent of the Agricultural Department, is a step in the right direction.

The accounts of the various agricultural and credit societies among the peasant proprietors show that they are in a flourishing condition, and continue to prove of utility to the class that makes use of them.

The production of locally grown foodstuffs has evidently considerably increased, owing in the first place to the energetic efforts made by the Agricultural Department in disseminating knowledge on this very essential subject, and also to the operation of the Government Corn Granary and Provision Depôt in Castries.

CANE-SUGAR TRADE OF THE UNITED STATES IN 1919.

An article appearing in *Sugar* for December 1919, on the sugar trade of the United States in that year, refers to 870,000,000 lb of sugar purchased during the fiscal year ending June 30, 1919, for account of the British Royal Commission on Sugar Supply in the allied countries in Europe. It is explained that this was refined sugar, the product of 930,000,000 lb. of raw sugar purchased from Cuba, and imported into the United States for the purpose of refining and then exporting to the United Kingdom, France, Italy, or foreign possessions of these countries, and therefore differs from ordinary exports.

Regarding ordinary imports, it is shown that the receipts of cane sugar from foreign countries and from non-contiguous territories during 1919 have broken all previous records. During the ten months ended with October 1919, the total receipts amounted to 8,237,453,522 lb. valued at $481,424,107, which is 1,759,988,484 lb. more than for the corresponding period in 1918, and represents an increase of 27·2 per cent. in one year. Shipments during the first ten months of 1919 amounted to 1,258,168,072 lb., valued at $96,982,888, against 286,251,092 lb., with a value of $18,930,821, in 1918—an increase of 339·5 per cent. in quantity, and 412·3 per cent. in value.

The receipts for the ten months ended October 1919 comprise 6,392,138,811 lb, valued at $355,725,617, imported from foreign countries, 1,103,655,180 lb. of raw sugar, valued at $71,998,124, and 23,902,500 lb of refined sugar, valued at $2,151,250, from Hawaii, and 717,757,031 lb., valued at $51,549,116, from Porto Rico. Domestic exports of 1,246,869,413 lb., valued at $96,033,653, shipments of 6,584,765 lb., valued at $618,031, to non-contiguous territories, and re-exports of 4,713,894 lb. of foreign sugar valued at $331,204, make up the total of 1,258,168,072 lb. of sugar, valued at $96,982,888, shipped in January-October 1919.

A striking feature of the sugar trade of 1919 is the fact that 3,033,380,480 lb. or 36·8 per cent. of the total imports of cane sugar during the ten months ended with October arrived in the United States during the last four months.

PLANT DISEASES.

THE PANAMA DISEASE OF BANANAS.

(*Concluded.*)

The severity and the spread of this disease are strikingly correlated with certain well defined weather conditions. Wet weather, especially if it is characterized by driving rains conducing to movement of surface water, is apparently a factor of considerable importance in the dissemination of the disease-producing organism. In Porto Rico, for instance, shortly after the rainy season has set in, there is a decided increase in the number of apparently new cases, and more rapid progress of the disease in plants already infected. Laboratory experiments show that the spores are very subject to injury by desiccation. Since the surface of the soil becomes very hot and dry during the dry season, it is unlikely that spores deposited thereon would survive. Another reason may be that the young fleshy roots, which are especially susceptible to infection, are not developed during the dry season, but push out from the rhizome in large numbers after the rains have set in.

In arid regions, where irrigation is necessary for the successful production of bananas, the disease is unknown. No case has been observed in the drier districts of southern Porto Rico, southern Jamaica, or northern Columbia. In such regions the intense heat and dryness of the surface of the soil would make the survival of the wind-borne spores impossible. In southern Jamaica the soil becomes so hot and dry that planters invariably set the bulbs with about 1 foot of the old pseudostem still attached, so that this succulent stem, when it rots, will furnish moisture for the young shoot, and prevent its death by 'boiling' as it is termed, though 'baking' would be a more descriptive word. It is believed therefore that the disease need never be feared in these dry regions.

In countries where there are no well marked wet and dry seasons, that is, where the rain is more or less evenly distributed throughout the year, optimum conditions for the spread of the fungus exist. This is attested by the virulence of the disease in the banana districts of Panama and Costa Rica.

In Surinam, where the annual precipitation is very heavy, and the rains are distributed over practically the whole year, the disease spread over the entire country in the short space of four years. In such regions it is not only highly infectious, but extremely virulent and aggressive.

CONTROL.—The present knowledge of the life-history of the disease-producing organism leads to the conclusion that the elimination of the disease as a source of injury to banana plantations, in countries where conditions are favourable to it, cannot be based on an attempt to eradicate the parasite. Any direct method of attack, such as protecting the plants by the application of fungicides, or eradication of the parasite in the soil by any method now in use, is out of the question. Sterilization of the soil is not economically practicable at the present price of bananas. Selection of disease-free bulbs is of value only where they are to be planted in soil which is not already infested. Control measures for this disease, as for other diseases of plants, would naturally group themselves under one or more of four headings, namely, exclusion, protection, eradication, and immunization.

(1) *Exclusion.*—Exclusion of diseased plants or otherwise infected material by means of legislation would be of value (1) in countries where the disease is not present, but in which conditions are such as favour the disease; (2) in similar regions where the disease is not yet firmly established; (3) where it is partly held in check by climatic conditions.

This last division would include Jamaica, Porto Rico, and perhaps Cuba. Laws with respect to such quarantine already exist in Jamaica. Besides regulations to prevent the introduction into the island of any new source of infection, it is required by law that any person occupying land on which plants infected with Panama disease exist, must give notice of the same to the Director of Agriculture, who then orders that the treatment perscribed by law be carried out. This consists of the destruction by fire of the diseased plant or plants, and other plants around them within a distance of 22 yards, after which the infected area is fenced in, and a local quarantine established for one year or more at the diseretion of the Director. Investigation of the life-history of the parasite shows that these laws are amply justified. Even, however, in places where such measures are applicable, they appear only calculated to alleviate the situation until some other method may be found to eliminate the disease.

(2) *Protection.*—Protection may be defined as the interposition of some effective barrier between the susceptible part of the host and the inoculating germs of the disease. As has been mentioned above, the susceptible parts of the banana plant are below the surface of the ground. Any method of attack therefore, similar in principle to the spraying of the parts above ground by fungicides, is of no value.

(3) *Eradication.*—Practically all efforts so far made in attempting to control this disease have been directed along the lines of eradicating the parasite.

The first principle of crop sanitation is to avoid planting infected bulbs, which invariably give rise to diseased plants. The necessity for selecting healthy bulbs for planting can not be too strongly impressed upon banana growers.

When a diseased individual is detected in the field, it should be immediately rooted out and destroyed by burning; otherwise it becomes a menace to surrounding plants, on account of the production and dispersal of disease-producing spores. Heedless neglect of any such diseased plants is bound to produce a harvest of new cases.

Eradication of the organism in the soil by allowing the land to remain fallow, rotation of crops, disinfection of the soil, mulching, flooding, and other methods have been tried but none has yet been found effectual.

The longevity of the organism is not definitely known, but it has been isolated from land which had not been planted to bananas for five years.

It has been found in studies on this disease that steam sterilization of the soil was very effective, but it is needless to say that under plantation conditions, this method is impracticable.

(4) *Immunization.*—The conclusion is arrived at that there is only one solution to the problem of the control and final eradication of the disease, and that is by the development of resistant strains of desirable varieties of banana.

Experiments have been started in this direction at the Porto Rico Agricultural Experiment Station. Although it is too soon to make definite statements as to the results, the indications point to a successful issue. It has been observed that an occasional plant growing in badly infested areas would resist the disease, and produce good bunches of fruit, and give

rise to healthy suckers. Such healthy plants had been surrounded by diseased ones for many generations. Suckers of these healthy plants have been removed to a specially prepared field artificially inoculated as heavily as possible. The progeny of any plants that survive will be subjected to the same treatment. If they in turn survive, it will be assumed that they can withstand the disease under any conditions, and they will be propagated and distributed as immune strains. It is recommended that similar experiments be started with commercial varieties in the countries where bananas are grown for export.

A SUBSTITUTE FOR YEAST.

To those of our readers who make their own bread, but who sometimes find it difficult to obtain fresh yeast, the following suggestion, kindly supplied by a lady correspondent in Grenada, may probably be useful. Our correspondent states that the suggestion is based on recent successful experiments of her own. The directions are as follows:—

Take a newly picked ripe cacao pod—if ¼ pint of fresh cacao juice be unobtainable; remove the beans; place them in a breakfast cup half filled with water, and leave them to steep overnight. Early next morning strain off the liquor; mix it with 2 oz. of leaven left over from the previous baking, ¾ pints of warm water, and sufficient flour to form a stiff batter; leave this to rise in a covered bowl for three or four hours, and then make the bread in the usual way.

This quantity is sufficient to raise 4lb. of flour in the form of bread, cakes, or buns. No fresh cacao juice is required for a month, if care is taken to reserve a portion of the dough as leaven for each successive baking, freshening it every morning and evening with a little flour.

THE WORLD'S SUPPLY OF COTTON.

In *The Times* Trade Supplement, January 17, 1920, attention is drawn to a series of articles which appeared in the daily edition of *The Times* that week from the pen of Professor Todd, the Secretary of the Cotton Committee of the Board of Trade. It is stated that these articles, by a man thoroughly qualified to speak on the present position and future prospects of the cotton industry, are calculated to make the most short-sighted cotton manufacturer reflect. The following paragraphs are reproduced from the article referred to above:—

Briefly the position is that Lancashire before the war depended on the United States for 85 per cent. of the cotton she used, while five-eighths of the world's crop was grown in that country. Last year's American crop was probably the worst in the past decade, and, coming as it did after a series of bad years, the shortage occasioned thereby is pronounced. Nor is this by any means the sole cause for anxiety. At the end of the last century the American mills consumed approximately one-third of the domestic production of that country; in 1917 and 1918 they consumed over half. Moreover, other countries have now come into the industrial arena, and are competitors for what supplies of cotton exist.

Yet if there were reasonable anticipation of increased production in the United States, all might be well. Unhappily Professor Todd shows that the boll weevil has made serious inroads on the yield; the cost of production has advanced enormously; planters have gone in for alternative crops; and the negro labour question has become extremely acute. There seems very little chance that there can be any relief as a result of increased production in the United Siates; nor does Professor Todd think that even the average output of pre-war years will be maintained except as a result of the inducement of very high prices. In other parts of the world, despite the laudable efforts of the British Cotton Growing Association, there is no possibility of increased production on a scale calculated to affect the issue to any great extent.

Meanwhile the demand for cotton goods is likely to increase. As the world becomes more prosperous the demand for clothing is certain to be accentuated, and fresh commercial uses are constantly being found for long staple cotton. The prospect before the Lancashire cotton industry cannot be regarded as other than extremely unsatisfactory.

In the same issue of *The Times* Trade Supplement another article appears, dealing with Egyptain cotton supplies. It is stated that :—

The position of Egyptian cotton is occasioning apprehension, if not positive alarm, in Lancashire.

It is not that the crop has failed in any way, although there has been difficulty and delay in getting supplies from the interior to the ports. The quantity of cotton available is apparently much below the world's requirements; a bigger demand for cotton than was foreseen has developed in the last few months, and it seems impossible to meet it to the full extent. While many Lancashire mills have secured good supplies, and are well placed for the present season at any rate, others are badly off, and there is a prospect of some stoppage of production of fine yarns wholly for want of cotton.

A number of influences have combined to increase the pull on the Egyptian crop. The shortage of American cotton of good grades, both in the big carry over from last season and in the current American crop, has led to some substitution of Egyptian cotton for the better kinds of American. Then the revival of business in cottons which set in, about September, in Manchester, covered many classes of fine or semi-fine fabrics in which Egyytian yarns are used. More important than either of these elements in the situation is the rise of a big demand for Egyptian cotton from the United States. Buyers from the United States have been in Egypt securing all that they could get hold of, and prepared to pay big, if not extravagant prices. The exports from Alexandria to the United States so far this season, total nearly 150,000 bales, against 12,000 to the corresponding date of last season!

There is an impression that the United States is anxious to secure Egyptian cotton in order to use it in the place of long stapled American, which is not in good supply. There may be some ground for this impression, but probably the truth is that in America, as in England, there is a greatly increased demand for Egyptian for industrial purposes more or less outside the cotton trade itself—as, for instance, in the manufacture of motor tyres. For the tyre covers, the fabric used is largely made from Egyptian cotton of medium counts, spun down to about 24's. This yarn makes a cloth which is peculiarly tough and durable. The motor trade is developing fast in the United States and England, and with about 6lb. of yarn going into every motor tyre that is made—24lb. to the set—it can be readily understood that motor requirements alone must absorb a considerable percentage of the entire supply.

MARKET REPORTS.

London.—The West India Committee Circular, February 19.

Balata—Venezuelan Block, no quotations; West Indian Sheet, No quotations.
Beeswax—No quotations.
Cacao—Trinidad, 129*s.* to 134*s.* Grenada, 118*s.* to 131*s.* 6*d.* St. Lucia, 108*s.* to 131*s.* Dominica, 122*s.* Jamaica, and St. Vincent, no quotations.
Copra—No quotations
Honey—No quotations
Lime Juice—Raw, 3*s.* 6*d.*; Concentrated, no quotations.
Pimento—6½*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T S Garraway & Co., February 17.

Arrowroot—$9·00 per 100 lb. duty paid.
Cacao—No recent sales
Coco-nuts—$45·00 husked nuts.
Hay—$5·50 per 100 lb.
Onions—Lottings at $20·00.
Peas, Split—No quotations; Canada, Market bare.
Potatoes—Market bare.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, February 24.

Bay Oil—28*s.* 6*d.*
Lime Oil—7*s.* for West Indian distilled, and 16*s.* for hand pressed.
Orange Oil—West Indian, 28*s.*

Trinidad.—Messrs. Gordon, Grant & Co., March 5.

Cacao—Venezuelan, $28·25; Trinidad, $26·00 to $26·50.
Coco-nut Oil—$2·40 per gallon.
Coffee—Venezuelan, 24c. per lb.
Copra—12¼c. per lb.
Dhal—$15·00 per 160 lb.
Onions—$15·00 per 100 lb.
Peas, Split—$12·00 per bag.
Potatoes—English, $6·00 per 100 lb.
Rice—Yellow, $12·50 to $13·00 White, $14·00 per bag.
Sugar—No sales made.

New York.—Messrs. Huth, Gillespie & Co., Inc February 3.

Cacao—Caracas, 24c. Grenada, 20c. Trinidad, 21c.; Jamaica, 18c. to 19c.
Coco-nuts—Jamaica selects, $65·00 per M; Trinidad $42·00 per M; culls, Jamaica, $65·00; Trinidad $42·00 per M.
Coffee—Jamaica, 19c. to 25c. per lb.
Ginger—21c. to 24c. per lb.
Goat Skins—Jamaica $1·60; Antigua and Barbados; $1·55 to $1·60; St. Thomas and St. Kitts, $1·55
Grape Fruit—Jamaica, $3·00 to $4·50.
Limes—8c. to 8½c.
Mace—40c. to 42c.
Nutmegs—27c. to 28c.
Oranges—$4·00 to $4·50.
Pimento—9¾c. to 10c. per lb.
Sugar—Centrifugals, 96°, 11c. c. & f.; Muscovados, 89°, 11c. Molasses, 89°, 11c.

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AGENTS FOR PUBLICATIONS OF THE IMPERIAL DEPARTMENT.

London: Messrs. Dulau & Co., Ltd., 34-36, Margaret Street, Cavendish Square, W.
West India Committee, 15, Seething Lane.
Barbados: Advocate Co., Ltd., Broad Street, Bridgetown.
Jamaica: The Educational Supply Company, 16, King Street, Kingston.
British Guiana: The Argosy Co., Ltd., Georgetown.
Trinidad: Messrs. Muir-Marshall & Co., Port-of-Spain.
Tobago: Mr. C. L. Plagemann, Scarborough.
Bahamas: Mr. N. D. Sands, Board of Agriculture, Nassau
Grenada: Messrs. Thos. Lawlor & Co., St. George.
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Montserrat: Mr. W. Robson, Botanic Station,
Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre.
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 801, Yonge Street, Toronto

AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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A Tropical Agricultural College in the British West Indies.

III.

IN the two previous numbers of this Journal the editorials reviewed the Report of the Committee appointed by the Secretary of State to consider the question of the establishment of a Tropical Agricultural College in the British West Indies. In this number it seems desirable to point out the relationship between such a college and the present Agricultural Departments, and some of the practical aspects of the training to be given in the college.

The past twenty years have witnessed the rise and development of Agricultural Departments in the colonies. These departments are now recognized as necessary parts of colonial administration, and that their work and activities are essential for the preservation and development of the agricultural industries of the colonies. These departments have accumulated much knowledge, and they are active in disseminating it; but the advice and instruction thus put forth is mainly addressed to those who are already engaged in the actual work of agriculture, to the older men, the actual planters. Furthermore, much of the advice and instruction is directed to the special problems which are confronting these older men in their daily work; it is special advice, and not orderly, considered instruction, intended to give its recipients the general outlook on agriculture which a proper course of training should involve. Consequently it tends to deal with such special points as the control of pests and diseases, or the special aspects of particular crops, such as sugar or cotton, while the general principles of agriculture have little discussion. There may thus arise a somewhat lop-sided manner of looking at agricultural problems, so that the younger men, anxious to obtain an insight into the scientific aspect of agriculture, are led to think, for instance, that agricultural science is mainly a matter of pests and diseases, or other special matters, and lose sight of much which is fundamental and basic, thus tending, through the very activity and zeal which they display, to acquire warped and ill-balanced ideas, whereby their chances of becoming successful planters are impaired.

The Agricultural Departments cannot undertake this fundamental teaching in regard to agricultural matters; they have neither the men nor the facilities for such work: it requires special equipment; and this means a college.

The college is thus necessary for the training of young men who are to carry on the agriculture of the future. The work is becoming so intricate and complex, and involves the application of the knowledge and advice of so many specialists, that none but a trained man can hope to deal successfully with all the phases of it, and be alert to take advantage of the various favourable opportunities which arise in connexion with his work and its associated business.

But there is another aspect. Knowledge relating to tropical agriculture is not easily acquired. While it has much that is in common with the agriculture of countries having temperate climates, it has very much that is utterly strange to those countries. The crops are different, the pests and diseases are different, and the manner of handling the soil must be different. How then must the requisite knowledge be obtained? Much has been acquired by the patient working of planters in the tropics during past years, and much has been added by the labours of scientific investigators still more recently; but much of this knowledge is only in the making: most of it is incomplete and scattered. The student or worker who desires to obtain information on matters pertaining to the higher phases of science as applied to tropical agriculture has a difficult task. It is very necessary then that there should be men entrusted with the duty of gathering together such knowledge as is available, and presenting it to students and workers in an orderly form. Something is attempted by the Agricultural Departments, but they can not undertake regular, systematic instruction in these matters; this requires a college with its various Professors and Lecturers, whose duty it is to collate the knowledge and put it before students in a considered form for their assimilation and application.

This idea goes far; it applies in the first place to those whose desire is to obtain a sound insight into matters of general agriculture, who desire to equip themselves mentally so as to be farmers and planters of the best and highest type. But it applies, with perhaps greater force, to those who require training in special matters of tropical bearing, to such as wish to become the plant pathologists, entomologists, mycologists, chemists, and other specialist workers and investigators dealing with tropical problems. Where are such men at present to get their training? General instruction in cognate matters is given in our Universities and Colleges in temperate countries, but there are few, if any, in British possessions which can give detailed instruction in these matters in their tropical aspects. It is now a matter of first necessity to have somewhere within the British Empire some institution in which young men can receive training in matters pertaining to tropical agricultural affairs; where they can handle actual tropical crops, and become familiar with their requirements; where the special problems relating to tropical soils can have consideration; where the future agronomists, agricultural chemists, entomologists, mycologists, economic botanists, and others can be trained. This can only be done through an Agricultural College situated in the tropics, and no better place exists for such an institution than the West Indies.

In considering this latter aspect of the training to be given, it may be pointed out that it will be of advantage to other Universities and Colleges, such as those in Great Britain or Canada, to be able to send their students to a tropical college in order to complete their training by gaining first-hand knowledge of tropical matters. Many of the graduates of these Universities and Colleges desire to undertake work in various tropical possessions abroad. As matters now stand they leave the institutions in which they have been trained without having had opportunities even of seeing many of the actual plants and other things with which their work is concerned. Consequently the first year or two of their time in the colonies is spent in what is practically a further period of training, in order to make them familiar with the objects on which their work is based. This is a wasteful process, and one which is not invariably successful.

It is seen then that the training to be given in the College must have many aspects; it must provide instruction for the youths of these colonies who wish to be educated in order to undertake work on plantations in the colonies themselves; further than that, it should provide two grades of education even for such youths. There are those who cannot afford a long time for study, who have to turn to wage-earning work without long delay, but who desire to enter on their work better equipped than those youths who pass directly from the secondary school to plantation work. For such a short course of instruction may suffice; but there are others who are able to afford time for thorough training, and who look to occupy the highest positions which agriculture can offer them. For such, a longer course is desirable, and

it is open to consider whether they may take the whole of their course in the Tropical College, or whether, some at least, may not desire to put in some of their time at a British, Canadian, or other University or College, and then to complete their tropical training in the West Indies. Some may do this, while others may take their whole course of study in the West Indies.

In addition to this, there must be the means of giving instruction in such special lines of work in their tropical aspect as entomology, mycology, and many other branches of science. The tropical aspects of these cannot be dealt with in any teaching establishment outside the tropics, for museum specimens, illustrations, and books cannot take the place of the things themselves, or reveal the natural surroundings in which the special tropical objects occur. Thus it is to be expected that students who have received a considerable part of their training in other Universities or Colleges, but who wish to be instructed in tropical matters, will come to the West Indies for the purpose. In this way it should be possible to give sound training to the important and ever-growing body of men who wish to take up work along special lines in tropical departments of agriculture, or in connexion with large companies or private firms, as specialists in plant pathology, in tropical soil problems, as tropical agricultural chemists, and many other lines of work, some of which are possibly not yet evident, but which will come into existence as knowledge grows, and men are available to apply it.

It is necessary to explain that the College is not merely intended to give instruction to local youths who contemplate becoming planters; this it must do, but it must do much more than that; and to effect its full purpose, it must from the outset have high academic ideals and status, so as to command the respect and evoke the sympathy and co-operation of Universities and Colleges over the sea. Its outlook and ideals must be broad and high.

The *Monthly Bulletin of Agricultural Intelligence and Plant Diseases*, issued by the International Institute of Agriculture, March 1919, which has only just been received at this Office, contains a note on cattle raising in Santo Domingo. This is said to be among the most promising industries in the Dominican Republic. It is estimated that there are 3,000,000 acres of land suitable for grazing in the Republic. These lands are well watered by numerous streams and rivers, and Guinea grass and other nutritious grasses grow luxuriantly on them. With one or two exceptions there are no large ranches, although nearly every farmer owns a few head of cattle.

VISIT OF THE PRINCE OF WALES AT BARBADOS.

His Royal Highness the Prince of Wales, on his way to Australia and New Zealand viâ the Panama Canal, honoured the island of Barbados with a short visit of about thirty-six hours, to the great joy of the people. The Prince arrived at 5 o'clock on Thursday evening, March 25, and left at daybreak on Saturday, having spent the whole day of Friday ashore.

The Prince, as is well known, takes a keen interest in agricultural matters in the Mother Country and also in the Dominion of Canada which he recently visited. This interest was shown on his visit to Barbados by his special request that he should be conducted over one of the sugar factories. Accordingly His Royal Highness visited Bulkeley, the largest sugar factory in the island, and was shown the process of manufacturing sugar from the cane.

In the course of conversation with the Imperial Commissioner of Agricultnre for the West Indies, the Prince brought up the subject of the proposed Tropical Agricultural College, and expressed his approbation of the scheme, and his hope that it might soon be successfully inaugurated.

AGRICULTURAL DEVELOPMENT OF BRITISH HONDURAS.

It will be remembered that Mr. W. R. Dunlop, Scientific Assistant on the Staff of the Imperial Department of Agriculture, recently left Barbados on a mission to British Honduras to advise on agricultural matters in that colony. The *Clarion*, March 4, 1920, contains a full report of the Annual General Meeting of the Chamber of Commerce in Belize, which Mr. Dunlop attended. Naturally his remarks were of a very general character, as he had not yet been long enough in the colony to study fully its agricultural prospects. He seems to think, however, with regard to the cultivation both of sugar-cane and rice, that considerable extension may well be expected in both these directions.

His Excellency the Governor of British Honduras also spoke at the same meeting, and suggested the advisability of resuscitating the Agricultural Society in the interests of the colony.

REMOVAL OF THE AUDUBON PARK SUGAR EXPERIMENT STATION.

According to the *Louisiana Planter*, February 21, 1920, there is great sorrow felt by the entire sugar-planting fraternity over the repeated decision of the Audubon Park Authorities in New Orleans to compel the Sugar Experiment Station, located there for many years, to move to some other place. Two years from March 1920, have been given the authorities of the station to remove from the park. The petition of the American Cane Growers' Association to the Park Board, asking them to reconsider their ruling, has apparently borne no fruit. The Board seems to be determined that the station shall not remain there.

There is a great deal of sentiment and sugar educational history attached to the present station, and hundreds of the leading sugar experts of the world have received their technical training there; these men will learn with great regret too of the dismantling of the Audubon Park Station.

COTTON NOTES.

SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost & Co, on Sea Island cotton in the Southern States, for the week ended February 24, 1920, is as follows :—

ISLANDS. Since our last circular report of January 24, the demand has continued active, with advancing prices, both for the odd bags classing Fine to Fully Fine, and the Planters' crop lots of Fully Fine to Extra Fine, resulting in sales, the buying being on account of the Northern Mills and for export to England and France.

The entire stock of odd bags classing Fine to Fully Fine has been sold, and the Planters' crop lots have been reduced to seven crops, aggregating about 100 bales. These crops are held at prices ranging from $1·10 to $1·50.

Based on the above scale, we quote :—

Planters' crops of Extra Fine @ $1·05 to $1·40, f.o.b. and freight.

Fine to FullyFine @ 95c., f.o.b. and freight.

GEORGIAS AND FLORIDAS. During the past three weeks there has been an active demand with advancing prices, taking the limited offerings both in Savannah and throughout the interior markets, the buying being on account of the Northern Mills.

This active demand has sprung up, it is reported, to supply the immediate wants of some mills whose purchases of Egyptian cotton have been much delayed in arrival in this country.

We quote, viz:—

Average Extra Choice @ 90c. to 95c., f.o.b. and freight.

The exports from Savannah since January 24 have been, to Havre 205 bales, Northern Mills, 1,668 bales, Southern Mills 330 bales, and from Jacksonville to Northern Mills 1,090 bales.

A NEW THEORY OF THE ORIGIN OF SEA ISLAND COTTON.

Sea Island cotton is generally considered to have originated from the West Indian perennial cotton (*Gossypium barbadense*).

At a meeting of the Manchester Literary and Philosophical Society held in 1830, Mr. John Kennedy, one of the two founders of the present firm of McConnel & Co., Ltd., read a letter (from which an extract is given below), which had appeared previously in the *Charlestown Courier* (South Carolina).

The writer of the letter (Thomas Spalding, of Darien, Georgia) states as follows : 'The Sea Island cotton was introduced directly from the Bahama Islands into Georgia. The seed, as I have been often informed by respectable gentlemen from the Bahamas, was in the first instance procured from a small island in the West Indies, celebrated for its cotton, called Anguilla. The winter of 1786 brought several parcels of cotton seed from the Bahamas to Georgia ; among them (in distinct remembrance upon my mind) was a parcel to the Governor Tatnall of Georgia, from a near relative of his, then Surveyor General of the Bahamas, and another parcel at the same time was transmitted by Colonel Roger Velsall, of Exuma, who was among the first, if not the first successful growers of cotton, to my father Mr. James Spalding, then residing on St. Simon's Island, Georgia. 'I know my father planted his cotton seed in the spring of 1787, upon the banks of a small rice field on St. Simon's Island. The land was rich and warm, the cotton grew large and blossomed, but did not ripen to fruit ; it however ratooned or grew from the roots the following year. The difficulty was now over ; the cotton adapted itself to the climate, and every successive year from 1787 saw the long staple cotton extending itself along the shores of Georgia and into South Carolina.'

During the progress of investigations on the mode of inheritance of characters in cotton, certain facts have come to hand which throw considerable light on the way in which Sea Island cotton probably originated.

Briefly, the facts suggest that Sea Island cotton originated from a natural cross between a glabrous broad-leaved West Indian native, with botanical affinities to *G. brasiliense*, and some variety of American Upland.

We may accept, as substantially correct, the statement of Spalding that the original Sea Island cotton seed came from Anguilla viâ the Bahamas. In what characters does Sea Island cotton differ from indigenous West Indian natives, and by what means were the new characters acquired? It will perhaps be convenient to summarize the salient differences between Sea Island, Upland, and West Indian Native in tabular form :—

	Sea Island.	Upland.	West Indian Native.
Habit.	Sympodial.	Sympodial.	Monopodial.
Resistance to Leaf-blister mite.	Susceptible.	Susceptible.	Practically immune.
Resistance to cotton worm.	"	"	Comparatively resistant.
Leaf.	Glabrous.	Hairy.	Glabrous.
Petal spot.	Present.	Absent.	Present or absent.
Pits in boll.	Sunken.	Superficial.	Sunken.
Boll loculi.	3-4	3-5	2-4
Lint.	40-55 m.	20-25 m.	30-35 m.
Seed.	Black with green tuft.	Woolly.	Black with green tuft.

It will be seen that while Sea Island cotton resembles the coarse-leaved West Indian native in many of its characters, it differs from it in being extraordinarily susceptible to the attacks of leaf-blister mite and cotton worm, and in its annual or sympodial habit—all of which characters are possessed by Upland cottons. Planted anywhere in the West Indies, and left to itself, Sea Island cotton could certainly not maintain itself. It would certainly succumb to the prevailing climatic conditions and to infestation with leaf-blister mite. Its behaviour is that characteristic of an exotic plant.

Experiments have shown that all West Indian native cotton breed true to the monopodial habit, i.e. all nodes on the mainaxis, up to about thirty, produce only vegetative branches. The combination of monopodial habit with great vegetative vigour, confers on these types their perennial character. Furthermore, Sea Island cotton breeds true to the sympodial habit, the first fruiting branch being put forth at nodes 8-14. In thousands of plants of both native and Sea Island cottons there has never been the slightest tendency observed for the native to develop the sympodial, or for Sea Island to take on the perennial habit. It may be remarked at this point that experiments were carried on in Barbados for many years, which had for their object the production, by gradual selection, of Sea Island from native. Needless to say these experiments were doomed to failure from the very outset. Selection by itself will not change perennial cotton into annual.

When the monopodial native is crossed with the sympodial Sea Island, or Upland, the F_1 generation is sympodial. This was found to be the case in Leake's experiments with the corresponding morphological forms found in Asiatic cottons.

In the second generation segregation occurs into monopodial and sympodial, though there is no strict line of demarcation. The majority of the plants, however, are sympodial and annual in habit, and breed true to this character in this generation cultures.

Only about one plant in 300 is really monopodial. In a cross between a coarse-leaved, glabrous West Indian Native and Upland, the first generation plants were morphologically, almost indistinguishable from Sea Island. They possessed the sympodial habit and susceptibility to leaf-blister mite of the Upland, combined with those morphological characters of the West Indian type which cause it to resemble Sea Island. In addition to this, the lint was over 40 mm. in length, and exceedingly fine and silky in texture, thus closely approaching Sea Is and in character.

In the second generation several plants were noted possessing the same general likeness to Sea Island.

We may thus hypothetically reconstruct what happened when West Indian native seed was introduced into the United States. The first year of growth showed nothing but perennial (monopodial) plants which did not arrive at maturity. If we postulate natural crossing to have taken place when they flowered the following year between these types and neighbouring Upland cottons, the natural hybrids, being early maturing and long-linted, would attract immediate attention, and the seeds from them would be carefully preserved and planted. Once the sympodial habit was acquired, selection of the most promising plants could quite conceivably have resulted in the development of the Sea Island variety as it is at present constituted.

While this hypothesis has more intrinsic probability as an explanation of the origin of Sea Island cotton than any other theory yet advanced, it must be admitted that the actual reconstruction of Sea Island cotton by this means has not been accomplished in recent practice. It must be borne in mind, however, that there exist many different strains of West Indian native which agree in being broad-leaved, glabrous, tufted-seeded, etc., but differ in other respects. The synthesis of Sea Island cotton could probably only be effected as a result of the segregation of some rare gametic combination derived from a cross between a special form of West Indian Native and perhaps also a special form of Upland.

S. C. H.

EXPERIMENTS WITH GREEN BOLLS OF SEA ISLAND COTTON.

In consequence of the ravages of the boll weevil, the Sea Island cotton crop of the United States would appear to be in danger of extinction. This opinion is based on the rapid decline in production during the past two years.

The Board of Trade Journal, February 15, 1920, draws attention to certain experiments which have been conducted on green bolls, by a treatment of them by what is known as the Spence-Harvey system. By means of this system it is hoped that the damage caused by the insect will be materially lessened. Under this system the bolls are gathered while green, and are treated by special machinery so as to extract the cotton.

A pamphlet issued by the Standard Cotton Company of America, dealing with the Spence-Harvey system of harvesting green cotton bolls, gives a certain amount of information on the subject.

Up to the present there are not more than two machines in actual operation, and it is not expected that more than 100 will be put out during 1920.

A bale of cotton treated by the Spence-Harvey process was recently sent to a large cotton mill at New Bedford, Massachusetts, where it was submitted to various processes of manufacture, and carefully tested.

It is stated that a decreased cost of cotton production by one-third, a reduction to a minumum of the loss through boll weevil ravages, and an increase in the quality of the cotton thus produced, are among the claims made for the Spence-Harvey process of harvesting green cotton bolls, and by a special process of mechanically maturing the bolls, and separating the cotton from them.

Recent tests were conducted at an experimental plant in Memphis, Tennessee. A quantity of green cotton bolls were picked in Mississippi early in August, and shipped to Memphis, where, it is said, in one hour after being received at the Harvey plant, fully opened, silky, clean cotton was being produced. The cotton was turned over to the gin. It was declared high grade, and easily handled.

After the green bolls are gathered they are carried to the plant. The bolls pass through three distinct continuous steps in the machine, which cleans, dries, and separates the cotton from the bolls ready for the gin. The machine is said to act like an incubator, improving the staple and seed, and advancing the process of opening a cotton boll approximately three weeks.

The Spence-Harvey process claims to produce matured cotton at the moment when it has reached its point of greatest strength, and is free from dirt or dust. It is also claimed that the seed of the green boll is as fully matured and as high in oil as the seed which has been taken from the naturally opened boll.

There is no difference in the ginning of the artificially opened and the stalk-opened cotton. All of the difficulties of the ginners in handling wet cotton are said to be overcome by the system of picking the green boll and passing it through the new machine, from which it emerges clean and dry.

Other experiments are being worked out with special regard to the boll weevil. It is the hope that even when the weevil gets into the field, part of a crop may be saved by an early gathering. An added factor is the fact that the hulls from an infested crop can be destroyed much more easily after being put through the machine, and the spread of the pest may be stopped in this way.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST

ST. VINCENT. During the month of February plant distribution included 1,400 onion plants, 52 miscellaneous, 327 coco-nut plants, 12 banana suckers, 600 sweet potato cuttings, and 41lb. cotton seed. In the Botanic Garden work of a general routine character was performed. Regarding staple crops, Mr. Jackson states that fair second pickings of cotton continue to be made. The reaping of Marie Galante cotton was commenced. Sugar-cane is giving good returns on the whole. Some few estates are manufacturing sugar, but the majority are making syrup. Some estates are not harvesting arrowroot on account of the conditions of the market. During the month 178,940lb. of seed cotton were received for ginning at the cotton ginnery. The ginnery purchased 53,372lb. of seed-cotton and ginned 32,612lb of lint. Cotton stainers are increasing somewhat, while the planters are continuing to destroy old cotton plants. A considerable amount of work along the line of Agricultural Instruction is recorded, including visits to land settlements and inspection of peasants' holdings. Excellent weather seems to have been experienced during the month, 7·46 inches of rain being recorded at the Botanic Station, making a total of 21·66 inches for the year; while at the Experiment Station, the precipitation registered for the month was 6·11 inches.

GRENADA. Plant distribution during the month of February included 400 onion seedlings, 302 lime seedlings, 8 ornamental, 2 economic, 2 budded oranges, 300 lb. yams, and 462 lb. horse beans. In addition, 107 lb. of onions. Mr. R. O. Williams, Superintendent of Agriculture, states that small gatherings of cacao are still being made. Regarding the sugar crop, grinding is in full swing. The price of corn has now reached 16*s.* to 17*s.* per barrel. In the cane fields at Grand Anse there is evidence of quite an appreciable loss by moth borer. Better cultivation is to be seen amongst the younger canes, and the estate programme provides for further cultivation amongst the ratoon canes. Advice was given to cut out dead hearts, collect eggs, etc. The Bourbon scale, appears to be on the increase during the present dry weather: bad attacks have been noticed in Grenada and Carriacou. The worst infestation was observed at Levera Sauteurs. Aphides were noticed on the young cacao leaves in the St. Cyr district.

The Food Crops Campaign is in progress. Posters have been issued, and leaflets written and printed. The Government have sanctioned a vote of £150 for the purchase of plants and seeds, and for propaganda work generally. Local committees have been appointed, and through these it is hoped to arrange meetings at which the officers of the Department and local gentlemen will deliver addresses.

Mr. Hitchcock, Agrostologist of the United States Department of Agriculture, visited the Botanic Garden on February 8, and Dr. Britton, Director in Chief of the New York Botanic Garden, visited on February 24. The rainfall at Richmond during the month was 1·40 inches.

ANTIGUA. During the month of February ordinary routine work was carried out in the Botanic Garden. The following comprised plant distribution: cane plants, 28,686; coco-nut plants, 48; decorative plants, 6; economic plants, 5; miscellaneous seeds, 7 packets. The young sugar-cane crop throughout the island, Mr. Gallwey states, continues to improve. The early planted cotton crop is drawing to a close. The cotton breeding plots at Skerretts suffered materially as the result of flower-bud maggot attacks and boll shedding during the month. The onion crop throughout the island is rapidly ripening, and a return of 2,500 crates is anticipated. Orders for 216lb. of onion seed have been received for the coming season. During the month 1,691lb. of seed cotton were purchased by the Antigua Cotton Growers' Association, making a total of 120,921lb. purchased to date. Mr. H. A. Ballou continued investigations on soil grubs at the Botanic Garden and on estates. At a special general meeting of the Agricultural and Commercial Society held during the month Mr. Algernon E. Aspinall, C.M.G., Secretary of the West India Committee, delivered an address and spoke on West Indian matters generally. The rainfall for the month was 3·10 inches.

A brief report on agricultural instruction during the month records the reaping of peasants' crops, chiefly cotton, in the English Harbour district, the destruction of the old cotton plants, and the preparation of the land for the planting of the new crop. Small areas are being planted in sweet potatoes, cassava, eddoes, etc.

Items of interest concerning the Antigua Government estate, Barbuda, for the month of February, have also been received. A good yield of cotton from a field of 7 acres is recorded, also the entire absence of cotton stainers, and decrease in attacks of cotton caterpillars. Good yields of cotton and ground provisions are also reported from most of the peasants' holdings.

The weather throughout the month was fairly dry, only 1·83 inches of rain having been recorded.

DOMINICA. The crop from the lime experiment station during the month of February amounted to 50 barrels of fruit, making a total of 1,715 barrels for eleven months. Plant distribution during the month was as follows: limes, 525; vanilla, 500; budded citrus, 18; grafted mangoes, 6; miscellaneous, 71; shade tree cuttings, 100; onion seedlings, 7,500; sugar-cane cuttings, 1,200; vegetable seeds sold, 210 packets. In the Botanic Garden usual routine work was performed. The green lime market, Mr. Jones states, is now showing some signs of activity, shipments during the month amounting to 1,405 barrels of fruit. Green limes, unparked, sold locally at prices varying from 12*s.* to 15*s.* per barrel. The local price for ripe limes remains at 6*s.*6*d.* per barrel, and that for raw juice at 10*d.* per gallon. The London quotation for concentrated juice is now £45. There is a good local demand for cacao. It is satisfactory to note that the export of coco-nuts is increasing. Experiments in the propagating of camphor trees, and in the pollination of cacao flowers are being undertaken. The rainfall for the month was 4·76 inches.

ST. KITTS. Work of usual routine nature was carried on in the Botanic Garden during the month of February. Plant distribution included 60 lb. of Indian corn, and 42 ornamental plants. The showers of the past month, Mr. Shepherd states, have kept the canes green and growing, affecting the sucrose and purity for factory conditions. The Basseterre Sugar Factory started work on February 2, and is making fair progress, but the canes are not yet fully ripe. The returns per acre, however, are up to estimate. The muscovado estates in the Northern district are all making syrup, owing to the high price obtainable for that article. The manufacture is controlled by means of samples sent to the Laboratory for examination. The young cane crop is germinating well and has made a good start. The old cotton plants have now been all turned in, and in the Northern district,

where the close season ends on February 1, planting has begun: the germination of the seed, all of which has been supplied from the Government Cotton Farm, is excellent. The investigating of soil grubs during the month by Mr. Ballou, Entomologist is recorded, as also a visit by Mr. A. E. Aspinall, C.M.G., Secretary of the West India Committee. The rainfall for the month was 3·27 inches.

NEVIS. The Agricultural Instructor, Mr. W. I. Howell, writing in regard to staple crops, states that the sugar-cane crop is being reaped on some estates with fairly good results, but the canes are still green. The young crop throughout the island is doing fairly well. The cotton crop is practically all reaped, and there is no second picking to speak of. The planters were under the impression that the close season for Nevis had to be fixed each year, but this is not so; and the dates fixed last season remain in operation until new dates are fixed. Cotton stainers were very plentiful during the early part of the month, but diminished towards the latter part. Preparation for planting the next cotton crop is in progress. The sweet potato crop is being reaped with good results. A small acreage was planted during the early part of the month. A meeting of cotton planters was held on February 25, when dates for the close season were fixed. The rainfall for the month was 2·86 inches.

MONTSERRAT. Plant distribution during the month of February included 1,200 bay plants, 1,630 cane cuttings, 1,110lb. cotton seed (for seed fields), 25 packets various beans. Seeds of the H.23-2-13 cotton have been sent to Egypt, St. Kitts, South Africa, British Virgin Islands, and the Dominican Republic. Nine distillations of bay leaves were made in the Botanic Garden, with very good results. Efforts have been made to effect crosses between Rangpur and the ordinary lime, with a view to raising hybrids. Taking the island as a whole, Mr. Robson states, the destruction of old cotton plants has probably never before been so effectively carried out. Estates are being considerably hampered in the preparation of cotton land, chiefly owing to the labourers being engaged in the cultivation of their own or rented land. The activity amongst this class of growers has never been so marked. With the advent of rains a very large area will at once be planted in cotton. Periodical observations are being undertaken to decide if certain species of Sida can be regarded as instrumental in carrying over the cotton stainer from one season to another. During the month 121 silk-cotton tress were felled, making a total of 1,926 destroyed to date. The rainfall recorded at Grove Station during the month was 3·69.

BRITISH VIRGIN ISLANDS. The Curator, Mr. C. A. Gomez, writes to say that considerable activity was centred around the onion cultivation at the Botanic Station, Tortola, during the month of February, and it may be said that the crop is again demonstrating its adaptability to Tortola conditions, in spite of the long spells of scorching sun and heat experienced. Onions transplanted in December last are maturing, and already the sale of the crop has started, 9c. and 10c. per lb. being obtained locally. The sowing of lime seeds, and setting of coco-nuts for establishing lime and coco-nut nurseries formed items of important work during the month. The following comprised plant distribution during the month: 1,900 cane plants, 3,300 onion plants, 117 miscellaneous decorative plants, 100 aralia cuttings. Up to date 86 bales of 260 lb. each of lint cotton have been shipped to Nevis, and sold in that island, first grade lint fetching 4*s*. 6*d*. per lb., and native 3*s*. 1*d*. per lb. Some growers still continue to send their seed-cotton to St. Kitts. The condition of the cotton fields in Tortola may be said to be fair. Both in Tortola and in Virgin Gorda the prospects of the second crop are decidedly promising. In Jost van Dykes, however, there has been an outbreak of cotton stainers of some severity. The sugar works at the Station, Tortola, commenced milling operations during the month. The sugar manufactured is of very good quality, and is being readily sold. In view of the great scarcity of sugar in the island, the peasants are very enthusiastic in preparing more land for this crop. Cotton stainers (*Dysdercus* spp.) have been prevalent during the month, especially on West End of Tortola and Jost van Dykes. Individual advice to planters about remedial means of controlling the pest has been given at the Station. It is feared that growers are somewhat slack in applying themselves to checking attacks of stainers. The total rainfall for the month was 3·55 inches.

AGRICULTURE IN BARBADOS.

Only in the hilly districts of the island have showers been frequent during March. In contrast with this, the low-lying parishes and the sea boards especially have been dry. But as January and February were very favourable months, there has, as yet, been no adverse effect on the crops.

The total rainfall to date for the year is just over 11 inches in the hilly parishes, as against 5 inches for the same period last year. In the centre of the island the difference is about 1½ inches, while in the south of the island the total is over 8 inches as against 3 inches for the same period last year.

The condition of the young cane crop is excellent, and the planters are rejoicing in a healthy and regular spring.

Some of the young canes are rapidly covering the banks, and the bunches are already full and very vigorous. In the black soil the Ba. 6032 particularly, is growing at a rapid pace.

All supplying seems now to have been practically done. The fields are also very clean, and at the present rate of growth farming will not be found necessary for a very long period.

As far as can be gathered, planters in general are exercising care and observation in the selection of the seedling varieties planted. There are conflicting reports in respect to the value of certain seedlings in the same area, but if this points to anything, it is to a closer observation than that which used to be exercised a decade ago. It is this observation which has led to the extended patronage of the B.H. 10 (12) in the red soil, and to marked increase in the area put under the Ba. 6032 this season in the black soil.

Ratooning stability is needed in the red soil, and in this the B.H. 10 (12) excels. In the black soil a plant cane of heavy tonnage is required, and in this quality the Ba. 6032 holds the premier place.

At last the reaping of the crop is in full swing. The rise in the price of syrup has been phenomenal. The market for this article opened at 70c. per gallon; on March 15, 91c. was offered. The price of choice molasses—75c. per gallon—is also, it is believed, the highest figure paid for this product in the history of the island. (The Barbados *Agricultural Reporter*, March 20, 1920.)

EDITORIAL NOTICES.

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Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

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The complete list of Agents will be found on page 4 of the cover.

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†Provided by the Imperial Department of Scientific and Industrial Research.

Agricultural News

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial deals with some practical aspects of the training which it is hoped will be given in the proposed Tropical Agricultural College.

The yellow stripe or Mosaic disease of sugar-cane, as occurring in the Argentine, is noticed under Plant Diseases, on page 110.

An article, which will be found on page 100, suggests a new theory of the origin of Sea Island cotton.

On page 106 there is a review of an exceedingly valuable book, which deals with mathematics, especially in relation to the study of agriculture.

Amendment of the St. Vincent Destruction Cotton Ordinance.

Since 1911 an Ordinance in St. Vincent required the effectual destruction *by fire*, before the end of every cotton season, of all cotton plants. An amendment has, however, been published on December 24, 1919, which permits the effectual *burying or destruction by fire* of all cotton plants before the end of every cotton season. The amendment provides that notwithstanding the alternative means of destruction allowed, the Agricultural Superintendent may direct all cotton plants in any land to be destroyed by fire only, if in his discretion he considers such method of destruction to be requisite.

The Use of Trash in the Cultivation of Ratoon Canes.

Experiments to test the value of piling the trash on the banks between rows of ratoon canes have been carried out on a plantation in Hawaii, the results of which are reported in *Facts About Sugar*, January 24, 1920.

In one experiment two varieties of cane were treated, namely, H.109 and D.1135, both as second ratoons.

Immediately after the cane was cut, the trash was piled around the stool, and not covered with soil in any way. In the no-trash control plots the trash was removed completely. In all other respects the plots received identical treatment.

As a result, both varieties of cane produced less cane and less sugar from the trashed plots. The difference in sugar was caused, not by any very great difference in weight of cane produced, but to a distinct difference in the quality of the juice. In all cases the juices from the trashed plots were poorer than those from the no-trashed plots.

From these results it would seem that trash when not buried is not as valuable as had been supposed, at least under Hawaiian conditions where irrigation is extensively employed. Under such conditions the particuar value of trashing cane fields as recognized in West Indian cane cultivation, would be minimised. The value of the trash piled on the rows, as is the usual custom in the West Indies, is that of a mulch for conserving soil moisture and keeping down the growth of weeds. As a fertilizer its value is not great.

Applied Plant Morphology.

An interesting review of a paper by Dr. C. A. Barber, which appeared in *Memoirs of the Agricultural Department* in India, June 1919, is published in *Nature*, January 29, 1920.

It is pointed out that the knowledge of the special physiology of a crop plant is of prime impor-

tance in efforts to improve the yield or quality of the product. The importance of the study of the morphology of the plant is no less evident, and the two lines of investigation should be carried on together.

Fuller investigation of the morphology of economic plants, especially those of the tropics, would doubtless be profitable both from the scientific and the commercial point of view. Dr. Barber's paper, referred to above, is an example of such work, in which the tillering or underground branching of Indian sugar-cane is discussed. The crop of the sugar-cane consists of aerial stems originating from the branching of an underground rhizome, hence a full knowledge of the methods of branching and the factors regulating the process is evidently desired.

The canes occurring in India comprise thick canes obtained from tropical sugar-growing countries, varieties cultivated in India, and wild Saccharums not used for sugar production. The results of the researches by Dr. Barber and his assistants show that branching in the various groups is of the same nature, but of very different degree. The characters of the branches of different classes are found to be so definite, that the harvest of canes can be easily separated and classified at the mill to ascertain their relative sugar content and milling quality.

A further point of practical interest arises in connexion with this question. The difference exhibited by canes of varying ages in the same clump are often much more marked in clumps raised from seedlings than in those grown from cuttings. The question as to whether this variation is handed on when the seedling is propagated vegetatively is not yet definitely known, and experiments are being conducted to determine this point, which is of considerable importance in the proper selection of seedlings.

Lemon Grass Cultivation in the United States.

Experiments in the cultivation of lemon grass for the production of lemon grass oil have been carried on for three consecutive years at the Orlando Field Station, Florida. According to a note in the *Perfumery and Essential Oil Record*, January 1920, these experiments have demonstrated that lemon grass can be grown with a fair degree of success on a type of poor sandy soil such as is found at that station. The returns per acre are, however, small, and it is doubtful if this crop could be grown profitably except on an extended scale of several hundreds or thousands of acres.

Manurial experiments showed that the employment of fertilizers increased the yield of grass by more than 100 per cent. The cost of the fertilizer and its application was approximately one-third of the increased profit resulting, thus giving a good return from its use. The average net profit per acre per year is stated as $13·05, but if operations were undertaken on a commercial scale, there would be other charges which are not taken into account in the results of the field experiments.

Sweet Pea Flowering in the West Indies.

Many horticulturists in the West Indies have endeavoured to cultivate the Sweet Pea of European and American gardens (*Lathyrus odoratus*), but the general experience seems to be that, while abundant vegetative growth is often obtained, the plants refuse to flower. Dr. S. C. Harland reports that he had tried many times to induce the Sweet Pea to flower in St. Vincent, but that he had always been unsuccessful until quite recently, when a pink variety of the Spencer type, procured from the United States Department of Agriculture, produced a single flowering spike after about three months growth. The flowers, however, were very small and quite scentless.

A Giant Bean.

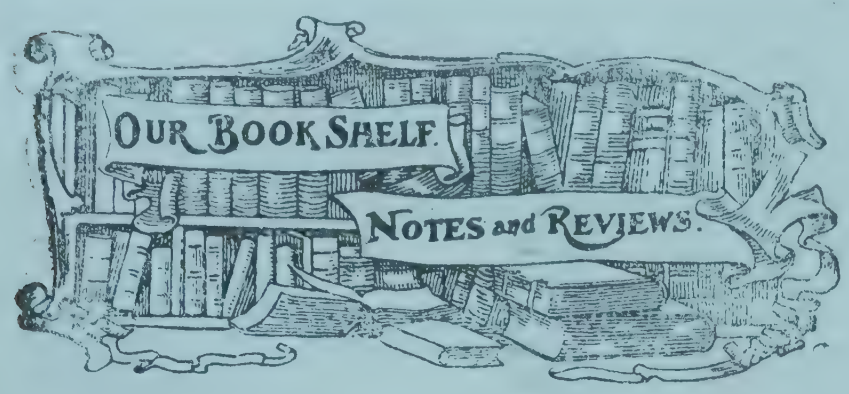
A note in the Inventory of Seeds and Plants Imported, issued September 6, 1919, by the Bureau of Plant Industry, United States Department of Agriculture, gives a description of a bean, which recalls the bean stalk of the old nursery tale. This giant bean is the 'taguana' of the Guaranis, an Indian tribe living in the interior of Paraguay. It may be only a form of the common bean (*Phaseolus vulgaris*), but if it is botanically only a form, from an agricultural point of view it is more than a variety. The bean has been cultivated by the Guaranis from a remote antiquity. The most notable peculiarity of this variety is its enormous growth. It has a long stem which grows to the length of 50 or 60 feet, so that in a wood it climbs to the top of high trees. In cultivation it develops less vegetative growth, but produces abundant crops of beans, so that a well developed plant will yield as a crop up to 10 or 12lb. of clean seed.

Food Value of Dairy Products

Circular No. 235 of the University of Illinois Agricultural Experiment Station, points out that dairy products, such as milk and cheese, have definitely been shown to be among the most economical of animal foods, both as regards their protein content and their total production of energy, and that it is advantageous from the standpoint of economy as well as of nourishment to increase the use of these products in the human diet.

Milk containing 4 per cent. of fat is a more economical source of protein and energy than meat, eggs, poultry, or fish. It is a complete food in itself, containing protein, fat, sugar, vitamines, and minerals.

Ordinary cheese costs very much less than meat, poultry, eggs, or fish in quantities sufficient to furnish equal amounts of protein or of total energy, and is an excellent substitute for those animal foods.



MATHEMATICS FOR COLLEGIATE STUDENTS OF AGRICULTURE AND GENERAL SCIENCE—Revised Edition—Kenyon & Lovitt. *The Macmillan Co.*, N.Y.—1918. Price 10*s.* 6*d.*

There was once a time when each branch of Natural Science was regarded as a distinct subject. One thought of Chemistry, Physics, Biology, and Mathematics as having no interrelationship with one another, while Agricultural Science was practically non-existent.

The barriers between these subjects are now broken down, and it is impossible to separate any one subject entirely from any other. Physical Chemistry is now a huge subject in itself, and Biology or Botany requires a general knowledge of Chemistry, Physics, and Mathematics, if a sound knowledge of the subject is required.

It is therefore necessary for science students to have a course of mathematics to suit their needs. Many branches of the subject will be unnecessary for their purposes, and it is a matter of some difficulty to provide an elementary course of mathematics which will fulfil their requirements without involving work which would not be of practical use, or work of a too difficult nature, while covering the necessary ground.

The reviewer has practical experience of the difficulties encountered by students who learn science without a fair basis of mathematics, and has also had experience of text-books of elementary science which try to explain mathematical reasoning in a non-mathematical way, to the complete mystification of the reader.

The above book aims at being a text-book for 'fresh men specialising in Agriculture, Chemistry, Biology, and Physics in colleges and technical schools.' It is written by two Professors of mathematics who are doubtless engaged in teaching this type of student, and whose experience is to be respected.

The book of necessity is of an elementary nature, comprising many different branches which are shortly but clearly treated.

The chapters on Graphic Representation, Small Errors and Empirical Equations are very interesting, and the latter is of especial use to those who have to interpret results by plotting points on squared paper.

The chapter on Statics is very brief, and merely gives a bare outline of the elementary parts of the subject, while the chapter on Conic Sections (treated analytically), would probably not convey very much to a student who had had no previous experience of the subject, unless his teaching was supplemented by lectures or private tuition.

A chapter on Annuities is given, but the authors refer the reader to another book, and merely content themselves with the briefest outlines, but adding copious exercises. No book on mathematics is of much use unless numerous examples are given to be worked out by the student. In this respect the book is amply supplied.

The portion of the book that would be of the greatest interest and use to students of Agriculture is from Chapter XIV to the end A brief mention of each of the chapters in order is given.

Chapter XIV deals with Averages. Definitions are given of the Arithmetic Average, the Weighted Arithmetic Average (the formula defining which is the same as that used for Centroids in Statics and Geometry), the Median, the Mode and the Geometric Average, with examples and explanations of each.

Chapter XV on Permutations and Combinations is very clearly put. This subject is always one of difficulty and confusion to the beginner, and the difficulties are reduced to a minimum by the clear way in which the book work is explained.

The deduction of the formula for the number of Combinations of n things K at time, from the corresponding formula for the Permutations is very nicely explained.

Chapter XVI is on the Binomial Expansion, and its applications to the laws of Heredity. The latter is of great interest, and shows the student at once that the Binomial Theorem has other uses than that of mechanically expanding expressions in series. Mendel's law assumes the greatest simplicity when dealt with in this way.

There is a rather serious misprint in this chapter; on page 276 paragraph 208 (1) the number one is put for the letter 'N.'

Chapter XVII is on the Compound Interest Law, with its applications to rate of increase or growth.

Chapter XVIII deals with Probability, and is very clearly put. The writers content themselves (and quite rightly) with giving results where the mathematical reasoning by which those results are obtained would be beyond the grasp of the student. Frequency Distribution Curves and the Probability Curve are discussed, the Standard Deviation and Coefficient of Variability are defined, and the way to find a probable error in a measurement is explained. The examples at the end are such as to exercise the formulae given in the chapter.

There is a misprint on page 293, paragraph 223, in the formula at the end where p_1, p_2 .... pn, is given instead of $p_1 . p_2$ .... pn, the substitute of a comma for a dot making the formula as given, meaningless.

The last chapter is on the Correlation of Events, and is explained quite clearly.

The book would be very useful in the hands of students at a college where they could attend lectures which would amplify the text of the book. One very good feature in the book is the references at the ends of paragraphs telling the student where he can obtain more detailed information on subjects that are too briefly treated in the text.

H. N. H.

ANTIGUA SUGAR FACTORY AN OBJECT-LESSON FOR INDIA.

In an article in *The Times*, February 14, 1920, Prof. P. Carmody, late Director of Agriculture, Trinidad, after reviewing the successful work of the Antigua Sugar Factory for the last fifteen years, goes on to show how the published results are of importance to the sugar industry of the Empire generally. He says that the point of particular mportance to the East Indies is that the good results

obtained at Antigua are due to improved methods of manufacture, rather than to any appreciable extension of the area under cultivation. In Antigua, as in other places, under the old processes 15 tons of cane produced only one ton of sugar; in the new factory 10 tons at first, and less than 9 tons since the addition of the fourteen-roller mill, produce one ton of high-grade sugar. During the fifteen years 100,000 tons of sugar have been produced from 928,000 tons of canes, which under the old process would have produced only 62,000 tons of sugar—a clear gain of 38,000 tons of sugar worth £431,000, and of this sum more than half has been returned to the cane growers.

It is on record that the production of sugar in the East Indies is 2,600,000 tons, and, taking the results at Antigua as a basis for calculation, there should be a possibility under improved processes of manufacture of increasing the production to over 4,000,000 tons. Whatever may be the adverse conditions in the East Indies, the outstanding facts are that an enormous area (2,200,000 acres) is under cane cultivation, and that the yield of *gur* from inferior canes averages for the whole of India 2,700 lb. per acre. If production on a co-operative basis were introduced there, on the lines that have proved so strikingly successful in Antigua, with a central up-to-date factory buying canes at a price based on the selling price of sugar, and supplementing this with an equitable share in the profits of a factory under good business management, there should be a very substantial increase in the output of sugar in the East Indies. In Trinidad, the East Indian takes very kindly to cane farming (there are 12,000 of them as compared with 9,000 West Indians). A piece of land under his own care is a great attraction to him, and he is a keen co operator.

The cost of erecting sugar factories has nearly doubled, and the selling price of sugar during the next ten or fifteen years cannot be foretold. It may be assumed that European beet-sugar factories, under post-war conditions, cannot profitably produce sugar to be sold at £10 a ton. But whatever the market price of sugar may be, and whatever the European factories may accomplish, the abundant and cheap supply of labour in the East Indies can produce sugar at a lower cost than any European country. There is already an enormous acreage under cane cultivation, and India has the further advantage of a home market for at least 1,600,000 tons, protected as it will be by the high freight and labour charges on imported sugar. No other part of the Empire possesses greater possibilities for relieving, by a substantial amount and within a reasonable time, the shortage in the world's supply of sugar.

FERTILIZER TESTS.

The following article, giving some results of co-operative work done in testing the value of various fertilizers in sugar-cane cultivation, is reproduced from the *Louisiana Planter*, January 31, 1920. Considering the increased attention that is being paid to the use of nitrate of soda as a fertilizer in the West Indies, the article with its careful tables is worth the notice of sugar planters. Only one of the tables is reproduced below for the sake of example:—

During the spring months of the past year co-operative fertilizer field tests were planned and conducted on some of the sugar plantations in Louisiana. The purpose of the tests was to determine in a practical way the best suitable combinations of nitrogen and phosphoric acid for sugar-cane. The tests were conducted on plant and stubble cane, and in all cases the fertilizers gave very profitable returns.

The mixture of 25lb. of nitrogen and 72lb. of phosphoric acid to the acre, which has been giving such encouraging results at the Sugar Experiment Station in New Orleans for a number of years, proved equally as good in the trials made on some of the plantations. Mr. Taggart, Assistant Director of the Sugar Experiment Station, states that this fertilizer shows best results when applied two years in succession, first on the plant cane and then the following year on the stubble crop.

The nitrate of soda gave very large margins of profit, but its use alone is not recommended A mixture of 200 lb. of nitrate of soda and 250 lb. of 18 per cent. acid phosphate is a more suitable fertilizer. In the fertilizer field tests this mixture, or one that was nearly its equivalent, gave good sucrose, and corresponding good tonnages

The results are only on one year's work, and are by no means conclusive. A duplication of the same tests during another year may not show such good returns, or may g ve results that are entirely different from this year's work. These results, therefore, should be regarded as one-year trials, and definite data cannot be drawn from them until they have been conducted for a certain period of years.

Size of field—8·81 acres.
Variety of cane—La. Purple, 1st year stubble.
Number of test plots—8.
Type of soil—Alluvial sandy loam

Plot No.	Fertilizer per acre.	Acres.	Tons per acre.
1	Check—No fertilizer	·75	8·06
2	400 lb. Nitrate of soda, 400lb. acid phosphate	1·0	16·40
3	400lb. Nitrate of soda	1·0	13·82
4	400lb. Acid phosphate	1·0	12·02
6	300lb. Nitrate of soda	1·11	15·14
7	600lb. Nitrate of soda (2 applications of 300 lb. each)	1·20	17·10
8	500lb. Tankage	1·25	10·88
9	Check—No fertilizer	1·50	9·65

Average of two check plots—8·85 tons per acre.

Cost and amounts of nitrogen and phosphoric acid used in tests:—

Plot No.	Nitrogen per acre, lb.	Phosphoric acid per acre, lb.	Cost of fertilizer per acre.
1.	60	64	$22·11
3.	60	...	16·92
4.	...	64	5·04
6.	45	...	12·74
7.	90	...	25·28
8.	41·15	34·35	18·70

Comparisons of fertilized and unfertilized plots:—

Plot No.	Increase over average of 2 check plots.	Net gain per acre.
2.	7·55	$91·14
3.	4·97	57·63
4.	3·17	42·51
6.	6·29	81·61
7.	8·25	97·67
8.	2·03	11·75

Above calculations made on price of $17·00 per ton of cane.

PLANT DISEASES.

THE YELLOW STRIPE OR MOSAIC DISEASE OF SUGAR-CANE IN THE ARGENTINE.

The article reproduced below was contributed to the *Louisiana Planter*, January 17, 1920, by G. L. Fawcett, formerly on the staff of the Porto Rico Experiment Station, and now Plant Pathologist at the Experiment Station at Tucuman, Argentina.

In the contributions to the *Louisiana Planter* on the yellow stripe disease of the sugar-cane there is a notable divergence of views as to the degree of virulence of the disease. For that reason something as to its effects, based on observations made in this country, may not be without interest.

Shortly after coming here some four years ago I noticed the peculiar spotting of the leaves characteristic of this disease, but was unable to identify it with the yellow stripe disease, although the description given by Wakker and Went, as it occurs in Java, indicated that it might be the same as the disease of this country. There was nothing in the Hawaiian publications to show that they have anything like that described from Java, or resembling the Mosaic disease of the Argentine, the leaf-splitting disease described by Cobb being apparently due to the combined effects of root disease and leaf fungus. As our Mosaic disease seemed to have little or no effect on the cane, the matter was let drop, attention being given to other diseases really injurious. Some time later descriptions of the new Porto Rican disease appeared in *El Mundo Azucarero*, with reproductions of photographs, which indicated that it might be the same as the Mosaic disease of this country. The Porto Rican disease was later found to be the same as the yellow stripe disease of Hawaii and Java. The identity of our Mosaic disease with that of these countries was further confirmed by the plant pathologists of Hawaii and Porto Rico, to whom photographs and descriptions of the disease were sent from here.

The yellow stripe disease is common in the cane-growing provinces of the Argentine, the only region free from it being a limited area in the Province of Salta, near Oran. Elsewhere it is impossible to find one plant free from the spotting, so that even if it were desired to select disease free material for planting, this would be impossible. The commonly grown Java varieties are all thoroughly infested, but differ considerably as to the degree to which the spots are developed. In 36 POJ they are only to be found by rather carefully examining the plants; in 234 POJ they are often conspicuous. These varieties in the literature of the Java Experiment Station are described as being subject to the disease, and it is probable that the original importations of these canes were infested. All the Java canes, and especially the 213 POJ and 36 POJ, give satisfactory yields under the system of cultivation in vogue here—that of leaving the cane several years without replanting, and giving no fertilizer and rather limited cultivation. The 213 POJ in one plot of this Station gave 22·5 tons per acre; in another, 24 tons, these being relatively large yields for canes grown under sub-tropical conditions.

The Criolla cane, which includes the three colour variations of this variety, known elsewhere as purple, striped or ribbon, and Cristalina or White Transparent, is uniformly affected, except in the region cited above. It is as common in the best as in the worst cane of this variety. This cane deteriorated in Tucuman, and is not now grown except in the more northern provinces. That the yellow stripe disease has been an important factor in the so-called degeneration is improbable. In those regions where the cane is unable to make a rapid growth immediately after being cut, owing to relatively low temperatures, it suffers from a winter decay of the roots and stubble. To this cause, combined with the bad effects on the soil of long ratooning without rotation, I ascribe the bad condition of the Criolla cane. It is true, however, that the Mosaic disease has long existed here. In one plantation in Jujuy, the present Administrator noticed it some fifteen years ago. The cane of this plantation, of the Criolla variety, is still excellent, although it yields somewhat less than formerly.

The Kavangire (Uba) does not show the spots, even in these places where it suffers pronouncedly from the winter decay of stubble and from root disease. In spite of this fact it is not grown here except to a limited extent, as varieties not immune to the disease, but vigorous and with better milling qualities are much preferred. The Zwinga and Yon Tan San, varieties of the Uba type, are also free from the disease.

There seems to be no direct relation between the occurrence of the yellow stripe disease and root disease, as the plants with spotted leaves often possess healthy and extensive root systems. Moreover, the disease is practically incurable, as the use of fertilizers and the best of cultivation do not cause any lessening in the amount of spotting under our field conditions. These facts are not in accord with those reported by Dr. Grey as occurring under Cuban conditions.

The varieties most conspicuously affected with the Mosaic are those of West Indian origin—the Barbados and Demerara canes—soft and broad-leaved varieties. The D.1135 is the only variety of this origin which does well under our conditions, and it is the only one little subject to the Mosaic.

It seems clear from the foregoing that any bad effects of the yellow stripe disease must be comparatively small. The successful growth here of several thoroughly infested varieties for years, under rather unfavourable conditions, attests to this fact. It would seem, moreover, that it is the resistance of these varieties to other diseases, rather than to the effects of the Mosaic, which makes possible their successful cultivation. It is difficult to reconcile these facts with the apparent destructiveness of the disease in Porto Rico, and it would seem that other factors not considered have had much to do with the losses ascribed to this disease in that island.

Statistics for St. Croix's 1918-19 sugar crop have finally been made up, and show that the amount of sugar exported from the island was 10,083 ordinary tons, and that about 500 tons was used for local consumption. This is exclusive of the manufacture of rum from cane direct, which amounted to 142,560 gallons, accounting for another 500 tons of sugar. The rum produced was almost all exported to Denmark. (*Facts About Sugar*, February 14, 1920.)

PRESERVING EGGS.

At some periods of the year eggs are usually abundant and fairly cheap; at other times they are scarce and dear. Fresh eggs properly preserved may be kept from six to ten months, and be almost as good for all household purposes as newly laid eggs. The following directions for preserving eggs are taken from the United States Department of Agriculture *Circular 15*, Bureau of Animal Industry:—

To preserve 15 dozen eggs in water-glass, the following directions should be followed:—

(1) Select a 5-gallon crock (earthen or stone) and clean it thoroughly, then scald and allow to dry.

(2) Heat 10 to 12 quarts of water to the boiling point and allow it to cool.

(3) When cool, measure out 9 quarts of water, place in the crock, and add 1 quart of sodium silicate (commonly called water-glass), which can be purchased at almost any drug store. Stir well so that the solution becomes thoroughly mixed.

The solution thus prepared is ready for the eggs, which may be put in all at once, or from time to time as they are obtainable. Care should be taken in putting them in the jar not to crack or break the shells; also make sure that the solution covers the eggs by at least 2 inches at all times. Put the crock containing the preserved eggs in a cool, dry place, cnd cover with a tight lid or waxed paper to prevent evaporation. To preserve a smaller or larger number of eggs, the solution should be mixed and prepared in the same proportion.

If water-glass is not obtainable, lime may be used. It is not considered as good as water-glass, as in some instances eggs preserved by this method have tasted slightly of lime, although at other times limewater has proved entirely satisfactory.

To preserve with lime, dissolve 2 lb. of unslaked lime in a small amount of water, and dilute with 5 gallons of water that has previously been boiled and cooled. Allow the mixture to stand until the lime settles, then pour off and use the clear liquid. Place clean, fresh eggs in a clean earthernware crock or jar, and pour the clear limewater into the vessel until the eggs are covered. At least 2 inches of the solution should cover the top layer of eggs.

If best results are to be obtained, the eggs should be fresh and clean. For this reason it is always best, when possible, to 'candle' the eggs carefully before preserving them, unless they are known to be strictly fresh. If an egg is only slightly soiled, a cloth dampened with vinegar may be used to remove the stains, but eggs should not be washed with water, cr soap and water, as water removes the protective coating that is on the shell, and may tend to cause the contents to spoil. Under no circumstances should badly soiled, or cracked eggs be used for preserving, as one or more such eggs in a jar may spoil all the others.

Fresh eggs, preserved according to these instructions, will usually keep from six to ten months, and can be used satisfactorily for all purposes in cooking and for the table If, however, preserved eggs are to be boiled, a small hole should be made with a pin in the larger end of the shell before placing them in the water, to allow the air in the egg to escape when heated, and thus prevent cracking.

TRINIDAD PITCH LAKE.

The famous pitch lake in Trinidad presents great difficulties in endeavours to ascertain its depth by boring operations, because the movement of the asphalt tends to break pipes or boring appliances driven into the lake to any considerable depth. An article in the *Journal of the Royal Society of Arts*, January 2, 1920, states that some borings recently made under the direction of the geologist of the New Trinidad Lake Asphalt Co. have reached a depth of 150 feet, the lowest depth yet attained. This deepest boring was taken at the centre of the pitck lake, and the asphalt was found to be of uniform character throughout. After completion of the boring the hole was observed to have shifted 25 feet at the surface in six weeks, and a survey showed that the movement existed as deep down as 100 feet. Other borings, not at the centre of the lake, shifted to a lesser extent. The movement of the asphalt seems to be similar in many respects to the ascending and descending currents in a kettle of boiling water.

The asphalt lake of Trinidad is a flat area of about 120 acres, forming a basin surrounded by low hills. The original elevation on the lake's surface was 137½ feet above sea-level, but mining operations have lowered this elevation to about 130 feet.

Crude asphalt, as it occurs in the lake, is of a very uniform composition, as has been determined by a number of analyses. The composition is approximately 30 per cent. moisture and 60 per cent. asphalt in a very intimate uniform emulsion, in which a large portion of the material is in a colloidal condition, together with a small amount of mineral matter. During the process of heating or drying, the moisture is removed by evaporation, but the asphalt and mineral matter remain in their uniform proportions. which is one of the important properties peculiar to the Trinidad lake asphalt, and not common to other mechanical mixtures of asphalt and mineral matter. In appearance, asphalt, when dried, changes from a dull black, spongy substance to a hard, brittle, shiny, jet black product.

Animals or wagons can pass across the lake if they continue moving, but any weight allowed to remain quiet on the surface will sink.

The holes dug in mining the asphalt soon fill to the same level as the rest of the lake, so digging can be repeatedly done in the same place. The lake is in constant, but slow and powerful movement, and material left upon its surface shifts its position, and finally subsides.

In many parts of the lake, particularly near the centre, a gas containing hydrogen sulphide is given off in noticeable quantities. The gas is similar to that obtained in the oil wells in the nighbourhood. At the centre of the pitch lake there is an area of soft, black, sticky, viscous asphalt approximately 50 feet wide.

Across the Gulf of Paria, in Venezuela, there is another asphalt lake known as the Bermudez Lake, from which large shipments of asphalt have been made to the United States. This asphalt, however, is of quite a different character to that from the Trinidad lake

MARKET REPORTS.

London.—The West India Committee Circular March 4.

Balata—Venezuelan Block, no quotations ; West Indian Sheet, 4*s*. 5½*d*.
Beeswax—No quotations.
Cacao—Trinidad, 130*s*. to 140*s*. Grenada, and St. Lucia, 130*s*. to 134*s*. 6*d*. Dominica, 122*s*. to 134*s*. Jamaica, and St. Vincent, no quotations.
Copra—£73, c.i.f.
Honey—No quotations
Lime Juice—Raw, 3*s*. to 3*s*. 6*d*. ; Concentrated, no quotations.
Pimento—6⅛*d*.
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T S. Garraway & Co., March 31.

Arrowroot—$9·00 per 100 lb. duty paid.
Cacao—No recent sales.
Coco-nuts—$52·00 husked nuts.
Hay—Market bare.
Onions—Lottings at $18·27.
Peas, Split—No quotations; Canada, Market bare.
Potatoes—Market bare.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, February 24.

Bay Oil—28*s*. 6*d*.
Lime Oil—7*s*. for West Indian distilled, and 16*s*. for hand-pressed.
Orange Oil—West Indian, 28*s*.

Trinidad.—Messrs. Gordon, Grant & Co., March 5.

Cacao—Venezuelan, $28·25 ; Trinidad, $26·00 to $26·50.
Coco-nut Oil—$2·40 per gallon.
Coffee—Venezuelan, 24c. per lb.
Copra—12¼c. per lb.
Dhal—$15·00 per 160 lb.
Onions—$15·00 per 100 lb.
Peas, Split—$12·00 per bag.
Potatoes—English, $6·00 per 100 lb.
Rice—Yellow, $12·50 to $13·00 White, $14·00 per bag.
Sugar—No sales made.

New York.—Messrs. Huth, Gillespie & Co., Inc. February 3.

Cacao—Caracas, 22½c. Grenada, 19¾c. to 20c. Trinidad, 20c. to 20½c. Jamaica, 18c. to 19c.
Coco-nuts—Jamaica selects, $66·00 per M; Trinidad $66·00 per M; culls, Jamaica, $34·00 ; Trinidad $34·00 per M.
Coffee—Jamaica, 18c. to 25c. per lb.
Ginger—22c. to 23c. per lb.
Goat Skins—Jamaica $1·50; Antigua and Barbados; $1·40 to $1·60 ; St. Thomas and St. Kitts, $1·30
Grape Fruit—Jamaica, $2·50 to $4·00.
Limes—$8·00 to $9·00
Mace—40c.
Nutmegs—26½c.
Oranges—$6·00 to $7·50.
Pimento—8¾c. per lb.
Sugar—Centrifugals, 96°, 10¼c. c. & f. ; Muscovados, 89°, No quotations. Molasses, 89°, No quotations.

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October 9, 1919.

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West India Committee, 15, Seething Lane.
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Jamaica : The Educational Supply Company, 16, King Street, Kingston.
British Guiana : The Argosy Co., Ltd., Georgetown.
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Tobago: Mr. C. L. Plagemann, Scarborough.
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Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre.
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 801, Yonge Street, Toronto.

AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

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West Indian Sea Island Cotton.

THE position occupied by West Indian Sea Island cotton requires to be reviewed at not infrequent intervals, for it is an unusual one and beset with some dangers.

This industry in the West Indies was originally started in the years about 1901 and 1902, as an endeavour to find some means of relief for those engaged in the sugar industry, which at that time was faced with the ruinous competition of bounty-fed beet sugar, and was proving unremunerative to British West Indian growers. The early trials were encouraging, and warranted the exercise of considerable attention and effort, in the hope that a definite and settled industry might arise in cotton growing. The results have justified these efforts, so that now Sea Island cotton forms an industry of importance to several West Indian communities.

Many lessons have been learned during the period in which the industry has been established. Perhaps the principal one is that the maintenance of a Sea Island cotton industry involves the conscious and determined effort of several classes in the places in which the industry is carried on. Furthermore, it involves the united action of the community of the locality. Individual effort is essential, but is capable of being rendered unavailing, unless community action is taken to ensure the maintenance of the right conditions, and the enforcement of the necessary precautions which are essential to the growth and production of high grade Sea Island cotton.

In these matters several classes of the community are concerned. Not only must the actual growers of the cotton be active and well informed concerning the requirements of their crop, but the Governments of the districts must be alert and smypathetic, so as to put into operation the enactments and regulations essential to success.

Several matters are now recognized as fundamental. These embrace the procuring of the right type of seed and the maintaining of its quality, the controlling of the many pests and diseases which attack the crop, and the establishment and maintenance of the right

methods of agriculture. Much work is necessary in order to arrive at sound knowledge concerning all the matters embraced in these general organizations, and this work falls on different classes. While much has been learned—enough, it is hoped, to give stability to the industry—much more knowledge remains to be acquired in order to improve and still further stabilize it. In this work the planters or growers are first involved, for they are primarily concerned with the success or failure of the crop, and the rewards of success go to them. It is they who must know where the difficulties lie, and be responsible for applying such remedies as may be pointed out to them.

The finding of the remedies, however, in many cases transcends their skill, and the aid of other investigators has to be sought. In such situations this aid is given by the Government, working through the medium of the Agricultural Departments. In the establishment of the industry in each of the islands where cotton is now successfully grown, it has been the common experience that the control of pests and diseases has been the one point upon which success or failure hinged. Fortunately a considerable measure of success has been secured, so that remedies have been found for the principal troubles. The work which has been required in order to attain this position has been very diverse and great; it has involved the exercise of much patience, and a high degree of scientific skill on the part of many workers. The application of the knowledge thus acquired needs care and thought on the part of the growers; but more than this, in some cases it is required that the application of these measures shall be general throughout the whole of the region concerned; individual action is inadequate; community action is essential; the further aid of the Government has therefore to be invoked, so as to make and enforce regulations for safeguarding the industry.

That it has been possible in the West Indies to apply the knowledge which careful study has made available concerning the manner in which cotton pests and diseases may be controlled, is mainly due to the fact that the regions to be dealt with are islands, and small islands at that. It has been possible to arouse the interests and sympathies of the growers and the Governments, and to give effect to the measures devised, and, at the same time, by the exercise of measures of quarantine, to prevent the nullification of the efforts by the neglect or carelessness of outsiders.

Not only have these measures of Government action, community action, and quarantine been effective in the matter of the control of pests and diseases, but they have also been of great value in permitting of the purification of the strains of cotton grown in each region, and the maintenance of that purity.

The advantages of isolation have been realized, but it must be observed that this has only been done by an unusual degree of mental interchange and intercourse. While there has been isolation of areas, there has been a breaking down of mental isolation, which has been of the greatest benefit to the industry.

A satisfactory position has been attained, but, as already noted, deliberate and conscious effort is necessary to maintain the security thus gained, and this effort involves the full co-operation of the several classes referred to. The degree of commercial success to which the industry has attained is not without its dangers. Should it lead the growers to become careless, or lead them to think that they are now so well informed regarding their industry that further reliance on the intelligent exercise of Government functions, or on the work of scientific investigators and students is unnecessary, it may be predicted that the downfall of the industry will speedily follow. This aspect of the situation should be thoroughly appreciated, not only by the growers, but also by the executive and scientific officers whose agencies are involved in maintaining the complex structure of the industry.

And now, as to the commercial position of the industry, an unexpected degree of success and importance has been attained on account of the diminished production, amounting almost, or quite, to the failure of the supplies from the American areas whence the greater or almost the whole of this highest grade cotton has been obtained. This has resulted from the invasion of these areas by the Mexican boll weevil, and illustrates the disadvantages attending a continental area in dealing with the control of the pests of this crop. The present position of the American source of supply is plainly indicated by means of recently published figures showing the quantity of high grade Sea Island cotton now produced in the Southern States as compared with the amount produced in former years.

As there are now practically no other sources of supply of the finer grades of this cotton other than the West Indies, it is evident that there is both commercial advantage and responsibility in the situation

Diminished supply inevitably leads to high prices, and it may be expected that high prices, though possibly not such high prices as are at present prevailing, will be maintained for some time. High prices in this case are justifiable. The class of cotton under consideration is largely used for expensive articles, in the manufacture of which there is the expenditure of much money and skill whereby the value of the raw material is greatly increased. Many of these products are articles of luxury for which the users can afford to pay good prices. High prices are also justified by the fact that there is a genuine shortage of supply—a shortage which is not likely to be speedily relieved; while in the creation and safeguarding of this supply much patience, care, and skill have to be exercised.

The agricultural communities, and the Governments of the colonies concerned now find themselves in possession of a valuable industry of which in fact they have almost a monoply. This industry is likely to be remunerative for some considerable time, and is capable of bringing wealth to the growers and revenue to the Governments, which rightly should derive from the industry reasonable support, particularly in view of the part which the Government, in its broadest sense, has played and must continue to play in connexion with the industry, if it is to persist. It should be the care of all concerned to see that no steps be left untaken to maintain the position to which West Indian Sea Island cotton has attained.

DEPARTMENT NEWS.

Mr. H. A. Ballou, M.Sc., Entomologist on the Staff of the Imperial Department of Agriculture for the West Indies, left Barbados by the S.S. 'Saba' on April 10 to attend an official Conference of Entomologists which is to be opened in London on June 1.

Mr. F. Hardy, B.A., Lecturer in Agricultural Science Barbados, has been appointed Chemist on the Staff of the Imperial Department of Agriculture. It is expected that Mr. Hardy will arrive in Barbados to take up the duties of his appointment about the end of July.

Sir Francis Watts, K.C.M.G., D.Sc., Imperial Commissioner of Agriculture for the West Indies, left Barbados in the R.M.S. 'Chignecto' on April 15 for St. Kitts on official business. He is expected to return in a fortnight's time.

WEED CONTROL AND FERTILIZATION.

Where cane fields have been cultivated and weeds eradicated from them for many years, as in Barbados, the benefits of applying fertilizers are well known. In some of the other islands, where from lack of labour such complete cultivation has not been possible, the application of artificial manures has not always seemed to be advisable. In *Facts about Sugar*, January 24, 1920, an interesting account of an experiment in Hawaii with regard to weed control and fertilization is recorded. As this question is of general interest to cane planters, most of the article is reproduced below :—

This was a test to determine the effect of weed growth on the growth of cane, and to determine the value of fertilizing in the presence and in the absence of weeds. The experiment was planned by L. D. Larsen and R. S. Thurston, and carried out by the latter. The experimental cane was D-1135 plant, on a non-irrigated field. The plan of the experiment was as follows : —

Plots.	No.	Treatment.
D	12	Weeds allowed to grow ; fertilizer.
E	12	No weeds ; fertilizer.
F	8	Weeds allowed to grow ; no fertilizer.
G	8	No weeds ; no fertilizer.

In the D and F plots weeding was done approximately as in the surrounding field, and at times the weeds were very bad. The E and G plots were kept free from weeds, either by cultivation, hoeing, or spraying.

The cane in this field, for some reason, died back to a large extent ; on this account the juices were very poor. The cane was sampled in carload lots at the mill and the juices composited for each treatment. It took about 15 tons of cane per ton of sugar. The results of the harvest were as follows :—

Plots.	Cane.	Q.R.	Sugar.
D	21·31	15 46	1·38
E	29·37	15·69	1·87
F	13·19	14·89	0·89
G	20·38	13·28	1·53

These results are very striking, in that they show that the weeds, in this case, completely overcame the beneficial effects of the fertilizer ; that is, the plots having no weeds and no fertilizer produced slightly more sugar than did the plots receiving fertilizer without perfect weed control.

Weed control produced as great gains as did fertilizing, if not greater.

The D and E plots received the same amount of fertilizer ; in addition to this, the E plots had perfect weed control and produced 8 tons of cane more than the D plots.

Comparing the D and F plots, where weeds were allowed, we find a gain of 8 tons of cane, due to fertilizing, in D. In this case either weed control or fertilizing produced a gain of 8 tons.

Further study shows that these gains are accumulative Weed control and fertilizer (E plots) produced 16 tons of cane more then no weed control and no fertilizer (F plots).

These results are very important as showing that full advantage can not be taken of heavy fertilizing unless weed control is carried out also. They also seem to indicate that, in times of acute labour shortage, the loss can be partly made up by fertilizing more, unless fertilization is already high-

SUGAR-CANE CULTIVATION IN ANTIGUA.

A section of the Report on the Agricultural Department, Antigua, for the year 1918-19, deals with the sugar industry in that island. Much of it is reproduced below, as of general interest to cane growers throughout the West Indies.

The quantity of sugar manufactured in the island during the year under report was estimated at 12,921 tons, most of which was crystals from the factories of Gunthorpes and Bendals.

The area now under sugar-cane cultivation is fertile, and, given a rainfall of between 50 and 55 inches per annum, good crops could be looked for with a certain amount of confidence. Unfortunately this amount is seldom obtained. From statistics compiled by the Agricultural Department it is seen that the mean annual rainfall for the past forty-five years amounted to 44·88 inches.

The main factor governing returns per acre is water-supply, and although the direct control of this is beyond planters, much can be done to conserve the amount available. Conservation may be brought about by the combination of three factors, namely, deep ploughing on heavy lands, the formation of dust mulches, and liberal manuring. A large proportion of fields are regularly ploughed by means of steam ploughs, and these implements are capable of ploughing to a considerable depth. When these are used, however, care should be taken not to bury the fertile surface soil and bring lifeless clay to the top. The fertility of fields might easily be affected for many years if this point is not kept in mind.

Much of the cane land in Antigua is cross-holed after ploughing. This method of cultivation has been carried on in Antigua for very many years, and there is no doubt that in general it has proved highly successful. It will, however, be seen that land prepared as described above, precludes the use of horse-drawn implements for weeding purposes, or for the preparation of dust mulches. A large draw hoe is the implement used for practically all operations after the fields have been cross-holed. This method of cultivation hinders the use of any but the lightest of horse-drawn implements.

It is obvious that many of the difficulties met with in Antigua in connexion with the use of implements in cane fields for dust mulching, etc., could be overcome if banks and furrows were made parallel to the drainage system.

From many points of view this is an important matter, for apart from moisture conservation, which might be brought about by dust mulching, the free use of implements would help to relieve the situation as regards scarcity of labour, which is somewhat acute at present. It must however not be overlooked that the methods of cultivation now in vogue are the result of generations of experience, and any new ones should be carefully tried on an experimental scale before being widely adopted. It is tentatively suggested that the formation of dust mulches, in places where the use of mule-drawn implements is not feasible, could be brought about by the means of some form of the numerous hand cultivators which are now placed on the market.

The preparation of the land for cane planting is commenced soon after harvest has been completed, which is usually about August, and is continued for four or five months. Planters realize the importance of early and good cultivation.

Some few years ago a considerable amount of interest was given locally to the question of the improvement of cane lands by means of green dressing crops. It is usually feasible for all planters to put at least a proportion of their fields under green dressings.

In the past, a number of experiments have been conducted by the Agricultural Department to discover which green dressing crop would best suit the conditions obtaining in this island. The experiments indicated that the Barbuda bean (*Phaseolus lunatus*) is probably the most suitable plant for the purpose. It is a moderately quick grower, and in a short space of time covers the ground and keeps down weeds. In addition, it is singularly free from insect attacks, and when once established, stands drought well. It gives a high yield of green material per acre. It must, however, be pointed out that when grown as a green dressing without supports, it is a shy bearer, but this need not be regarded by the planter of Antigua as a serious drawback, for supplies of seed can be obtained from Barbuda, where it is extensively grown by peasants for seed purposes. In addition to this, the horse beans (Canavalias) are hardy and useful for the purpose under discussion.

On some estates ploughing is retarded, on account of the custom of feeding stock during the dry season on the young shoots of ratoons in fields which should be under cultivation for new planting. Where pasture land is scarce, the problem of feeding stock out of the reaping season is a serious one. The building of silos, which on certain estates has already received attention, would help to relieve this. These could be filled with cane tops during the harvest, when there is an abundance, for use in the time of scarcity.

In Antigua the question of rotation in connexion with sugar-cane culivation has never been seriously tackled by planters, although they realize it may be one of great importance. Experiments are now being conducted which will probably throw some light on this question in the future. These are discussed below There is no doubt, however, that it would be good policy, until the question as to whether definite rotation would pay or not is settled, that all fields, whenever practicable, should be made to bear a crop of green dressings, with the view of bringing the land into better heart by the addition of organic matter, which is deficient in practically all Antigua soils. If these crops were planted thickly, a good cover could be obtained in from two to three months, and this would leave sufficient time to plant all varieties of canes.

A series of rotation experiments was commenced during the year under report, with the view of obtaining information in connexion with rotation of crops for sugar-cane land. These consisted of five series, and it is hoped that they will be conducted on the same land for a considerable period of time, and that in this way useful information will be obtained. The question of rotating crops in connexion with sugar-cane has often been discussed, but this is the first time on record that definite experiments have been laid out with the object of obtaining reliable information on the subject. The following gives the rotations which are suggested : —

Plot 1.	First year, plant canes. Second year, first ratoons. Third year, cotton, followed by green dressing crop.
Plot 2.	First year, plant canes with a catch crop of maize. Second year, first ratoons. Third year, second ratoons.
Plot 3.	First year, plant canes. Second year, first ratoons. Third year, second ratoons, followed by crop of sweet potatoes.
Plot 4.	First year plant canes. Second year, first ratoons. Third year, yams .

One of the problems that the local agriculturist has to face is the obtaining of supplies of pen manure in sufficient quantities to keep his fields in good condition. It is realized that approximately 20 tons per acre of good pen manure are required for fields when cultivated, if good returns are to be looked for, but unfortunately it is not always possible to obtain this. On estates where large herds of cattle are kept, the rule that no field be cultivated without a sufficient application of manure is strictly adhered to, but on others which are not in such an enviable position, the management is forced to leave a portion of the land unmanured. Every effort should be made to overcome this ; and to augment the supply of manure, trash, grass, and leaves of various trees, which go under the general term of ' bush,' should be put in pens to increase the supply. Some of the rapid growing grasses such as Kaffir corn, Sudan grass, etc., might be grown in conjunction with a leguminous crop such as cowpeas, so as to form a balanced ration, and thrown into pens. Much of this would, in the ordinary course of event, be eaten by the stock, but the daily allowance should be more than the animal's requirements, so as to build up the manure supply. Much has been written in the past in connexion with this subject, but it is of such importance that repetition cannot do harm.

As has been demonstrated by experiments conducted by the Antigua Agricultural Department, it is not sound practice in Antigua, with its limited rainfall, to apply artificial manures to plant canes that have received a fair dressing of pen manure. In connexion with ratoons, however, when normal rains fall, it is profitable to apply sulphate of ammonia or some similar manure at the rate of 2 cwt. per acre.

On lands of indifferent fertility, the general practice in Antigua is to ratoon sugar canes only once. On some lands, however, second and third ratoons are often grown. The question of the number of times that a field should be run for ratoons is an important one ; it affects the cost of the maintenance of an estate, the labour-supply, and the amount of manure available for distribution among other fields ; it also affects yield. It will be seen that the owner or manager of an estate, before arriving at a decision concerning a field which he contemplates ratooning, must carefully estimate the probable cost of labour, etc., to produce on that field a crop of plant canes, and he must weigh carefully against this, the estimated value of the crop if left for ratooning. This is undoubtedly done, but it is possible that he does not take into account the value which would ultimately accrue to the fertility of any field by the more frequent cultivation it would receive if not ratooned. As stated above, this is a point of importance, and it is suggested that the heavy lands in certain parts of the island would improve considerably in fertility, if only first, or, at the most, second ratoons were grown on them.

SUGAR FACTORIES IN JAMAICA.

On February 14, the formal opening of the 10,000 ton sugar factory at Bernard Lodge in the parish of St. Catherine, Jamaica, took place in the presence of a large gathering of people, including His Excellency Sir Leslie Probyn, K.C.M.G., the Governor, who in his opening speech congratulated the proprietors, Messrs. Keeling and Lindo, on their enterprise.

This factory, which is at present the largest in Jamaica, is equipped in a thoroughly up-to-date manner, and when in full working order is expected to deal with about 12,000 tons of cane per day.

The supply of cane will be obtained from large properties owned by the proprietors, and also from numerous cane farmers who have made contracts for the supply of cane to the factory.

It is announced in *Sugar*, February 1920, that another sugar factory will soon be erected in Jamaica. The situation of this factory, it is stated, will be at Island estate in the parish of St. Elizabeth. The owner of the factory is Mr. A. E. Harrison, a large land-owner himself, and also the attorney in Jamaica for several properties belonging to the Earl of Dudley. The factory will be of 3,000 tons capacity, and though small in comparison to the Bernard Lodge Central, which has just been opened, it is sure to prove of great benefit to the district where it will be located. It is expected to be ready to take off the 1921 crop. Reaping usually starts in Jamaica during January of each year.

The erection of these factories shows that the development of the sugar industry in Jamaica is progressing. It is estimated that the output of sugar from the island for the present crop will be a record one, and there does not seem to be any likelihood of falling prices.

SUGAR PRODUCTION IN FLORIDA.

It has frequently been stated that Louisiana is the only one of the United States in which the sugar-cane can be profitably grown, and that Louisiana has already reached the limit of its possible production.

From recent articles however in American sugar journals, it seems likely that a large development of sugar production will shortly take place in Florida.

Historically, it appears that sugar cane was first cultivated in the United States in Florida, where a plantation was established as far back as 1767 for the purpose of growing sugar-cane and indigo. The enterprise, however, does not seem to have been successful, and it was only shortly before the American Civil War that an attempt was made to revive the industry. In 1860 Florida was credited with the production of a little more than 2,000,000 lb. of sugar. The Civil War seems to have practically extinguished the industry in the State.

Nevertheless, the production of syrup has been carried on extensively in Florida for many years, and during the past three years attention has been given to the possibility of developing the sugar industry on a large scale.

In the Everglades district hundreds of thousands of acres of land are being reclaimed by drainage operations. This land is thoroughly well adapted to cane growing. It is said that it has been fully demonstrated that this new land can grow crops of cane of more than average quantity and quality, and only the application of capital in the erection of modern sugar mills is needed to give Florida a position as an important source of sugar-supply.

In *Facts About Sugar*, March 16, 1920, the formation of at least three large companies for the purpose of growing cane and manufacturing sugar in the above-mentioned district of Florida is noted. It is stated also, that the area under cane in Florida at present is 16,318 acres, from which syrup and sugar are produced to the value of $2,686,129. With the interest now being attracted to the industry, it is regarded as certain that a rapid expansion in production will take place in the next few years.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. LUCIA. Plant distribution during the month of February included 59 ornamental plants and 6 budded oranges. The lime crop, Mr. Brooks states, is practically over; small pickings of cacao continue, and reaping of the sugar-cane crop is in full swing. The Agricultural Superintendent visited all the districts of the island during the month. The rainfall recorded at the Botanic Garden for the month was 6·89 inches; at the Agricultural and Botanic Station, the precipitation was 4·05 inches.

DOMINICA. The lime crop from the lime experiment station during the month of March was 15 barrels, making a total crop for the year of 1,730 barrels of limes, which realized locally £625 6*s.* 7*d.*, giving an average of 7*s.* 2¾*d.* per barrel. Plant distribution consisted of 1,825 lime plants, 62 budded citrus, 32 nutmegs, 20 cacao, 3 grafted mango, 9 miscellaneous, 4,600 cane cuttings, 100 shade tree cuttings, and 140 packets of vegetable seeds sold. The total receipts of the Agricultural Department from all sources for the year ended March 31, Mr. Jones states, amounted to £1,220 19*s.* 7*d.* The local prices for ripe limes and lime juice remained unchanged during the month. Concentrated lime juice is quoted at £45 in London. The price paid for green limes rose to 16*s.* per barrel. Sir Francis Watts, K.C.M.G., Imperial Commissioner of Agriculture, visited the Botanic Garden on March 5 and 17; he was accompanied on the first occasion by Mr. F. E Keefer, Secretary for External Affairs in the Canadian Dominion Parliament. Mr. H. A. Ballou, Entomologist on the staff of the Imperial Department of Agriculture, also paid a visit to the Garden on March 17. A set of thermometers was received, and has been mounted in the small meteorological shed during the month. Records will be taken and published. The rainfall for the month was 3·80 inches.

MONTSERRAT. During the month of March the following types of Sea Island cotton were planted in the Experiment Station: H. 23 strain, 63 types; H. 9 (new selections), 27 types; hybrid cottons, 6 types; and 5 fuzzy-seeded types. Plant distribution included 300 bay plants, 274 lb. yams, various beans, 38 packets. A small Chattanooga cane mill was erected at the Experiment Station. Two special distillations of bay leaves were made during the month to determine if any advantage resulted from drying the leaves before distillation. Forty-eight fruits are developing from crosses between the Rangpur and the ordinary lime. The weather during the month, Mr. Robson states, was fairly satisfactory for the establishing of the new cotton crop, and the larger portion of the area was planted. There seem to be no complaints this season about unsatisfactory germination, as was the case last season. The remainder of the 1919 cotton crop was shipped about the middle of the month: the total crop is now known to approximate 548,000 lb. of lint: the exact acreage has not yet been determined. All the important cotton estates have established cotton seed fields of the strain recommended by the Department, viz. H. 23, No. 2. Cotton stainers are still noticed to be abundant on the plant known locally as 'Twelve o'clock,' and careful observations are being made to determine if this plant is instrumental in tiding the stainer over from one season to another. The juices of the twenty-two varieties of sugar-cane reaped from the experiment plot at Farrels have been sent to the Government Laboratory, Antigua, for analysis. The B.H. 10 (12) gave o the heaviest yield. Seeds of *Momordica cochinchinensis* have also been sent to the Government Laboratory for determination of their oil contest. Slow progress is being made with the destruction of the remaining silk-cotton trees, the total number destroyed to date being 2,070. A scheme is on foot to inaugurate a Provision Gardens Competition in the island. The rainfall recorded at Grove Station during the month was 3·67 inches, the total for the year being 12·57 inches. The month was showery, rain being recorded on twenty-two separate days.

ANTIGUA. Mr. A. Gallwey writes to say that the dry weather experienced during the month rendered all agricultural operations at Skerretts impossible. In the Botanic Garden ordinary routine work was performed, special attention being given to daily waterings in order to keep the plants alive. Plant distribution comprised 3,590 cane plants, 20 decorative and 5 economic plants, 2 packets of vegetable seeds and 1 box of yam tubers. The growth of the young sugar-cane crop throughout the island has been somewhat retarded on account of the dry weather. On some estates the scorching of some of the young shoots is taking place. The date fixed by Proclamation for the destruction of all cotton plants is April 15, the close season when no cotton shall be planted, being from April 15 to May 15 inclusive. The onion crop is drawing to a close: 500 crates of onions have been shipped to date by the Onion Growers' Association, while 34,611 lb. were received at the Onion House during ths month. Sir Francis Watts, K.C.M.G. Imperial Commissioner of Agriculture for the West Indies, accompanied by Mr. H. A. Ballou, Entomologist on the Staff of the Imperial Department of Agriculture, made a tour of inspection at the Botanic Station and other places of agricultural interest during the month. On behalf of the Cotton Growers' Association, 3,106 lb. of seed-cotton were purchased during the month, the total quantity purchased to date being 15,199 lb; while 4 bales of lint cotton comprising 1,000 lb net, were sold on the local market at 5*s.* 6*d.* per lb. At a general meeting of the Agricultural and Commercial Society held during the month, Sir. Francis Watts addressed the members of the Society on the proposed establishment in the West Indies of a Tropical Agricultural College. The rainfall for the month was 1·27 inches; for the year, to date, 6 92 inches.

A brief report on agricultural instruction work for the month of March states that the peasants in the English Harbour District were chiefly occupied with the picking of cotton, for which operation the dry weather experienced was very advantageous. On the other hand, the growth of provision crops had been considerably affected. Preparations of land for next season's planting have been made, and several applications for seed from the Cotton Growers' Association have been received.

ST. KITTS. Usual routine work was carried on in the Botanic Garden during the month of March. The weather, Mr. Shepherd states, is dry, and much watering is needed. Plant distribution comprised 3,600 cane cuttings locally, and 500 to Tortola. The reaping of the cane crop is in full swing both in the central factory and the muscovado estates. The canes are not fully ripe, as is shown by the factory results. Syrup making has taken the place of muscovado sugar in most instances, owing to the high prices. The young cane crop is in fair condition, but rain is now needed for bringing on late supplies. Labour conditions are more satisfactory, but there is barely sufficient for present needs, even with the advanced rate of wages. Cotton has been planted on the estates in the northern district where the close season ended n March 1. The germination is excellent, and the stand

of young plants most promising. Preparation for plantings in the Basseterre district is rapidly in progress. The rainfall for the month was 1·12 inches; for the year to date, 9·65 inches.

NEVIS. The Agricultural Instructor, in notes of interest during the month of March, states that the dry weather during the month was unfavourable to the growing crops. Plant distribution included 11,000 sweet potato cuttings, 24 lb. yams, 30 lb. peanuts, and 20 lb. rounceval peas. The reaping of the cane crop is in progress throughout the island. Practically all the sugar and syrup made will be sold to a local purchaser. With regard to this crop, it may be noticed that many old windmills, which have been disused for twenty or thirty years, are again being utilized for the manufacture of syrup. Fairly good returns are obtained from many of the fields, but from others very indifferent ones. The young crop is making good progress, and is in very much better condition than the previous crop at the same time last year. Preparation for cotton in many places is almost completed, and there is likely to be an increase in the acreage put under cultivation. The old cotton plants were not all destroyed by the date of the close season, but there are very much fewer about than there have ever been at this time of the year. Practically the whole island is using seed from the Government Seed Farm. No planting has been done on account of the dry weather. The sweet potato crop has been nearly all reaped, with good results. The rainfall for the month was 1·25 inches, for the year to date, 7·82 inches.

AGRICULTURE IN BARBADOS.

The past fortnight has been the driest period of the whole year, and the rainfall for March was below the average. Even in the hilly districts during the past two weeks there have been only the lightest showers.

The total rainfall for March in almost every lowlying district is only just over an inch, and in the hilly parishes slightly over 3 inches. While this is the record for the last month of the first quarter of the year, the three months just ended, taken as a whole, have been far from unfavourable.

The old crop is being rapidly reaped. In this process, both the windmills and the factories have taken their full share.

It is well that reaping should proceed at a good pace, for the fields have very rapidly changed to a brown colour, and in a short time the canes will begin to lose their tops, and, as a consequence, decrease in weight. This rapid change is due, not so much to the dry weather during March, as to the fact that the canes have not matured naturally.

The parish of St. Andrew alone seems to be yielding a high tonnage, although 30 tons from a few fields of plant canes in the parish of Christ Church have been reported. It is stated that this yield had been obtained from both the B. H. 10 (12) and the Ba. 6032.

In St. Andrew the yield generally from plant canes is between 35 to 38 tons, and from ratoons about 25 tons per acre. In the red soil the average yield, including ratoons, is about 20 tons. In St. James the yield on some estates in the neighbourhood of the coastline is only 17 tons.

With reference to improved machinery, which of course means more effective milling, it may be stated that a 70 per cent. recovery with the old steam mill was considered a satisfactory result. To-day the recovery with a good modern mill is 97 per cent. and 95 per cent. is being reached at some of our factories. In addition to this, there is the advent of the chemist who knows how to secure the best and most economical results during the process of manufacture. The application of this knowledge is as important as the most efficient machinery.

Since the canes have been removed from the fields, it has not been possiole to do much tillage for the planting of either corn or potatoes. Here and there corn holes have been dug, and small spots have been prepared for early yams.

The potatoes now being dug are yielding a very fair return, and are being sold at $1·56 per 100 lb, and generally retailed at 5lb. for 10c.

NITROGEN FROM THE AIR.

The final report of the Nitrogen Products Committee has recently been issued. It is reviewed in the *Chamber of Commerce Journal*, February 13, 1920, from which the following is quoted :—

This Committee was appointed in June 1916, to consider the question of establishing in Great Britain and other parts of the Empire, some of the newer processes for fixing atmospheric nitrogen, in order to provide supplies of the nitrogen compounds essential for munitions and agriculture alike. The report is a voluminous one, and space does not permit of more than a brief survey of the Committee's recommendations. It is shown that the present demands for nitrogen for agriculture in the United Kingdom are already more than double the pre-war demand, and that in future the requirements will be still greater. In order therefore to meet this future demand, the Committee recommend the establishment forthwith of the synthetic ammonia (Haber) process on a commercial unit scale, and its expansion as rapidly as possible to a minimum of 10,000 tons of ammonia per annum. The Billingham-on-Tees factory is suggested for the purpose, if such a course is practicable. The cost would undoubtedly be great, but the Committee consider that, from the military aspect, we ought to manufacture a sufficiency of nitrates in this country to render us independent of the saltpetre imported from Chile for the nitrogen compounds for high explosives. The Committee also recommend the establishment without delay of the calcium cyanamide process, either by private enterprise (State supported if necessary) or as a public work, and sufficient to give an output of about 60,000 tons of cyanamide per annum. It is also recommended that the ammonia oxidation process should be established on a scale sufficient to produce about 10,000 tons of strong nitric acid per annum, or its equivalent in nitrates. Other recommendations comprise the trial, on a working scale, of various promising processes for the fixation or recovery of nitrogen ; the continuation, under the auspices of the Government, for the general benefit of the country, of the researches on the nitrogen problem initiated during the war ; the framing of a co-ordinated policy for safeguarding the future nitrogen requirements of the Empire, the suggestion being that advisory bodies should be set up in various parts of the Empire to furnish the Imperial authority with the necessary data ; and the official collection and publication of comprehensive statistics for the nitrogen industries of the United Kingdom, and for the home comsumption of coal by various classes of users and industries.

EDITORIAL NOTICES.

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Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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†Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of Present Issue.

The editorial reviews the present position of West Indian Sea Island cotton.

Under Insect Notes, on page 122, among other articles, will be found an interesting one on machinery used for poisoning the cotton boll weevil.

The appearance of the Mosaic disease of sugarcane in Trinidad is noted under Plant Diseases on page 126.

The movement in Trinidad with regard to the establishment of a Tropical Agricultural College receives attention on page 123.

Rainfall in Dominica in 1919.

Copies of rainfall returns of Dominica for 1919 have been forwarded to this Office by Mr. Joseph Jones, Curator of the Botanic Garden. It appears that the mean rainfall for twenty-seven stations was 113·90 inches; for thirteen leeward coast stations the mean was 84·36 inches; for three windward coast stations 134·45 inches; for four inland stations 193·59 inches; and for seven Lasoye stations 114·43 inches. The highest total recorded was at Brantridge, where 293·12 inches fell during the year, and the lowest, as usual, was at Battalie on the leeward coast, where only 49·23 inches are reported. Compared with the rainfall for the two previous years, that of 1919 shows an increase. In 1917 the mean for thirty stations was 110·53 inches, and in 1918 it was 100·80 inches.

The Manawa Yam.

A note in the *Inventory of Seeds and Plants Imported*, issued by the United States Department of Agriculture, September 6, 1919, states that a very peculiar yam, which appears to be distinct from any of the cultivated yams of Porto Rico, or any of the wild sorts, has been received from Panama under the name of the Manawà. It seems that this variety of yam, though apparently native to that region, is not commonly cultivated even there. It is reported, however, to be a heavy yielder, and to come to maturity two or three months earlier than the more commonly cultivated types. It is slightly sweet, with an excellent flavour of its own, and the size and shape are attractive. The mealy whiteness of the flesh when cooked, the smoothness of the skin, and the shape and size of the yam would seem to make it a desirable variety for table use. It is stated, however, that when baked the skin is disagreeably bitter, and cannot be eaten.

In connexion with this it may be remarked that an *Agricultural Extension Note*, published by the Porto Rico Agricultural Experiment Station, records that several varieties of yam cultivated at the Station have been distributed over the island. One of these varieties, called the 'Potato Yam,' which from its description seems to resemble very closely the yam referred to above, is reported to have given from 18 oz. of seed tubers, a yield of 37 lb. 9oz.

Calcium Arsenate as an Insecticide.

On another page of the present issue of this Journal will be found a note on machinery for poisoning the cotton boll weevil. An emergency bulletin from the United States Department of Agriculture, dated March 1, 1920, recommends as an insecticide, calcium arsenate applied in the form of a dry powder or dust, which should be used, it is stated, without the addition of lime or any other carrier.

Because of the danger of securing an improperly manufactured calcium arsenate, the advice is given to

purchase only material guaranteed to conform to the following specifications:—

Not less than 40 per cent. arsenic pentoxide.
Not more than 0·75 per cent. water-soluble arsenic pentoxide.
Density not less than 80 or more than 100 cubic inches per lb.

If the material meets these specifications it will be in the most satisfactory condition for dusting, and will be perfectly safe to use. A properly made calcium arsenate will keep indefinitely, if stored in a reasonably dry place.

The use of calicum arsenate is not nearly as dangerous to man and animals as that of Paris green; it does not possess the caustic characteristics of the latter, but it is undoubtedly attended with a certain amount of danger. Hence precautions should be taken to prevent the material being swallowed, and also to prevent, as much as possible, the inhalation of the dust in breathing. Absorption through the skin may also take place, and therefore excessive handling of the poison should be avoided. This danger can be reduced by frequent washings. If calcium arsenate is properly made it will not injure plants. In case any burning or scorching of the leaves should be noted, the use of this material should immediately be discontinued, as a comparatively small amount of leaf-burning may easily induce a serious amount of fruit-shedding.

It has been found that, with experienced operators handling the dusting machinery, satisfactory results can be secured from the use of about 5 lb. of calcium arsenate per acre for each application, but a new operator will generally have to be supplied with about 7 lb. per acre, which figure ought to form the basis of calculations.

Guadeloupe Sugar.

A sample of the average quality of sugar produced in Guadeloupe for exportation to France has been forwarded to the Imperial Commissioner of Agriculture by Mr. J. Sydney Dash, Director of the Station Agronomique, of Guadeloupe. It is quite a good sample of what is known in the sugar market as 'Plantations White'. Mr. Dash states that such sugar is being retailed locally at about 3½*d.* per lb., and that each Usine in the island is required by the Government to contribute its pro rata share for local consumption.

With regard to the prospects of the sugar industry in Guadeloupe, it appears that the Station Agronomique is showing evidence of good service, and is making its influence felt. The present crop is likely to be larger than for some few years past, and, on the whole, the cultivation is also better. One practice, which it seems has largely prevailed in the past in Guadeloupe, namely, keeping canes for third ratoons, is now being discouraged.

Mr. Dash considers that nowhere in the West Indies are the soil and climatic conditions more favourable for cane cultivation than in the French colonies, and that planters and sugar manufacturers there are now fully alive to the benefits that will accrue to the industry from increased care in the cultivation of the cane and in the manufacture of sugar.

Cultivation of Sugar Beets in England.

An article in the *Journal of the Ministry of Agriculture* draws attention to the formation of a company for the purpose of carrying out at Kelham, near Newark, sugar production on commercial lines. The capital of the company is to be nominally £1,000,000, but only half of this is to be issued, and of this half the sum of £250,000 is to be taken up by the Government, and £250,000 by the general public. The dividend upon the public capital will be guaranteed by the Government for ten years, at 5 per cent.

It will be seen, therefore, that the Government is taking a very practical share in the work of establishing a sugar industry in England. The home-grown article has a preference of more than £6 4*s.* per ton over the imported foreign article, and of nearly £1 19*s.* per ton over the sugar which is imported into the British market from British Dominions and Dependencies.

England is nearly the largest consumer of sugar in the world. Even at the low prices ruling before the war, there was consumed in the United Kingdom £25,000 000 worth of sugar every year. This is an immense market, and it seems a pity that England should so long have dispensed with the economic and industrial benefits of the great and always increasing demand for sugar.

The Relation of Certain Acidic to Basic Constituents of the Soil.

An article in *Soil Science*, October 1919, gives an account of certain experiments conducted on the relation of certain acidic to basic constituents of the soil, effected by ammonium sulphate and nitrate of soda.

It is well known that the continuous use of ammonium sulphate produces an acid condition in soil, whereas nitrate of soda tends to the production of an alkaline condition. The former salt is referred to as a physiologically acid salt, while the latter is physiologically alkaline. These two terms are significant phrases. The first indicates, for example, that ammonium sulphate is active in producing a condition in the soil which affects the plant from a physiological standpoint in much the same manner as does an acid. Great variation in acidity is shown to exist between soils receiving nitrogen in nitrate of soda, as compared with those which receive it in sulphate of ammonia.

The conclusion reached by the experimenter, Mr. L. P. Howard, of the Rhode Island Agricultural Experiment Station, is that the acidity in a soil caused by long-continued use of ammonium sulphate is the result of a change in the ratio of acids to bases. The position normally occupied by the stronger bases, such as calcium and magnesium, has been taken by weaker bases, such as iron and aluminum. The neutrality of the soil solution can no longer be maintained, since salts of these weak bases dissociate.

INSECT NOTES.

THE PINK BOLL WORM IN TEXAS.

In a letter recently received from Dr. W. D. Hunter, of the United States Federal Horticultural Board, interesting information with regard to the control of the pink boll worm has been received.

Dr Hunter states that the complications regarding the pink boll worm in Texas continue. In 1897 an infestation covering all or parts of seven counties was discovered in the southern-eastern part of the State. A non-cotton zone for the season of 1918 was proclaimed. No infestation was found in the cotton that season. On this account, the planting of cotton was allowed under restrictions during 1919. However, infestation has reappeared generally in the territory originally infested. This is a clear demonstration that a one-year non-cotton zone is not effective. We made, writes Dr. Hunter, thousands of examinations of malvaceous plants other than cotton during both 1918 and 1919. No traces of infestation were found. We can only conclude, therefore, that the infestation was carried over from 1917 to 1919 in cotton seed which had fallen to the ground in the fields, and escaped the clean up.

At Hearne in Robertson county, Texas, an infestation was found in 1917. A non-cotton zone has been maintained there for two years, apparently with perfect success as no indication of recurrence of the pests has been discovered.

Dr. Hunter's remarks indicate the difficulty attending attempts to exterminate such an insect as the pink boll worm. The ability of the resting-stage larvae to remain for long periods in the cotton seed and then to transform to pupa and moth, makes this a particularly difficult insect to deal with. A very few scattered seeds which escaped destruction at the time of cleaning up may be quite sufficient to carry over the infestation, not only over one clear planting season, but quite possibly over two or more. Only the most persis tent application of thorough methods of cleaning up, and constant vigilance over a period of several years, even when there are no signs of the recurrence of the pest, can be expected to give satisfactory results.

The cotton-growing portions of the West Indies have so far remained free from infestation by the pink boll worm, but the occurrence of this pest generally throughout Brazil and Mexico makes it a constant menace, if cotton seed is brought into these islands from those countries, or from any country which may receive seed from them.

MACHINERY FOR POISONING THE COTTON BOLL WEEVIL.

References have been made in recent numbers of the *Agricultural News* to the experiments and field trials that have been made in the United States in poisoning the cotton boll weevil.

For many years all attempts to control the cotton boll weevil by means of poison failed to give any encouragement that this line of treatment would ever be successful. With the introduction, however, of calcium arsenate as an insecticide, the hope was revived that a means of combating this pest had been found. The particular value of calcium arsenate for this purpose lies in the fact that it can be obtained in a very finely divided condition, so that when it is properly applied, fine particles of the poison can be made to penetrate to every part of the cotton plant. For this purqose suitable machinery is absolutely necessary. Machines have been produced which have given sufficiently good results to indicate that this method may yet become thoroughly successful under ordinary field conditions. *Farmer's Bulletin 1098*, issued by the United States Department of Agriculture, deals at length with dusting machinery for cotton boll weevil control.

This interesting Bulletin gives descriptions of the construction and working of the several different kinds of machines which have been developed for the purpose, but it principally deals with the difficulties which have been met in the operating of such machines, and indicates the respects in which improvemeuts are needed.

The dusting machines are of three general types: a hand machine of the ordinary powder gun type in which the poisoned dust is thrown out by means of a current of air generated by a small fan which is worked by hand. Another is the power machine in which a gasolene engine, mounted on a platform waggon hauled by animals, drives the fan which produces the air power for the distribution of the poison. A third form is that in which an animal drawn platform truck carries the distributing machinery, the power for which is communicated from the wheels of the truck. This last is said to be the most effective, or at least, to have the smallest number of drawbacks in operation. Emphasis is laid, however, on the fact that the bulletin is to be considered only as a progress report, and that the statements are not to be taken as in any way final. Dusting machinery for cotton poisoning is strictly in an experimental stage, and it is to be expected that improvements will be developed from time to time for years to come.

THE COWPEA WEEVIL.

Dr. S. C. Harland, in a paper recording the results of his studies in the inheritance of certain characters in the cowpea, refers to the occurrence of, and the damage done by, the cowpea weevil (*Chalcodermus aeneus*) in St. Vincent.

This appears to be the first record of the occurrence of this insect in the West Indies The identification is based on a comparison of the insect in St. Vincent with drawings of the cowpea weevil in a Bulletin of the United States Department of Agriculture. The insect in St. Vincent is smaller than that in the United States, and it may prove to be a closely related species instead of being identical with it.

At least three species of the genus Chalcodermus are recorded from the West Indies.

The important thing to note at the moment is that Dr. Harland found that the cowpea weevil in St. Vincent caused very serious injury to cowpeas growing in the Experiment Station where they were being studied.

The eggs of *Chalcodermus aeneus* are laid in the growing pea, by means of a puncture through the wall of the pod into the pea, made by the adult female by means of the mouth parts at the end of the proboscis. The larva feeds inside the growing pea, entirely destroying it. Sometimes the attack may be so severe that every seed in the pods is destroyed in this way, most of the pods on the plants being attacked.

It was found that, by planting a variety of cowpea which was continuous in its blossoming and fruiting over a considerable period, the weevil could be trapped and effectively controlled by collecting all the pods on these cowpeas at intervals of three days for a period of five or six weeks.

The numbers of the weevils were so far reduced that it was possible for the experiment plots of cowpeas to produce very satisfactory amounts of seeds. This system of cleaning up was found to be effective for two seasons.

THE TROPICAL AGRICULTURAL COLLEGE.

At a meeting of the Agricultural Society, Trinidad, on March 26, at which the question of the Tropical Agricultural College was discussed, Mr. G. Moody Stuart moved the following resolutions :—

(1) The Society having considered the Report of the Tropical Agricultural College Committee, and the accompanying Despatch from the Secretary of State, resolves that His Excellency the Governor be respectfully informed that the Society heartily welcomes the proposals in the Report, and is of opinion that, if they are carried out, the results will be of the highest importance for the future prosperity of the colony and the West Indies generally.

(2) The Society suggests that the best means of raising the initial sum required for the establishment of the College would be by a tax on produce raised in the colony during the years 1921 and 1922, at the rate of 4*d.* per 100 lb. of cacao, 2*s.* 3*d.* per 100 lb. of sugar, 1*s.* per 1,000 coco-nuts, and 3*s.* per 1,000 lb. of copra.

In his speech on moving the resolutions, Mr. Moody Stuart pointed out that for the initial expenditure in founding the College £50,000 was required as a minimum. The report suggested that this could be raised by voluntary subscriptions. He had, however, spoken to several planters in Trinidad, and all of them agreed with him in thinking that it would be much better to raise this sum by a tax on produce, at a rate that would not be burdensome to any. Their strong opinion was that the expense should be borne by all, as all will reap the benefit Another advantage in raising the money by taxation was that it would then be a charge on one's business, as it ought to be, and so income tax and super tax would not have to be paid on it ; while a voluntary contribution would be treated as a profit, and would be loaded with these charges. Another and conclusive reason for proceeding in this manner by taxation was that it could be carried out promptly, and prompt action was necessary. Trinidad had its chance now. It would be well not to miss it, or it would be missed for ever.

Mr. Moody Stuart added that much more than £50,000 was required for full equipment. A model sugar factory would alone require a large sum which was not included in the £50,000 asked for. There was no doubt, however, that good support would be received from other colonies, and from voluntary contributions, if Trinidad took the step of providing the first £50,000.

Mr. E. A. Robinson in cordially seconding the report, paid a well-merited tribute of appreciation of the work done by the local Department of Agriculture. He said, however, that there was naturally a deficiency in the continuity of the work of the Department owing to the fact that after a member of the Staff had been three or four years in the colony, and had learnt to understand local conditions, he was likely to be removed to some other country which offered better inducements. He believed that the remedy for this would be the Agricultural College which would supply men who, after being trained in the Universities in a temperate climate, would come here and study special circumstances. Thus, when the necessity arose, the Agricultural Department would always be able to get a man who had already obtained experience in local agriculture.

After having been supported by many other members of the Society, the resolutions were carried unanimously.

His Excellency the Governor of Trinidad, who presided at the meeting, said that he desired to congratulate the Agricultural Society most heartily in being first to what he might call 'get a move on' in the matter. Another point on which he wanted to congratulate the Society was that they were a unique body in that they had come to the Government, and said, 'Tax us'. He had never heard of any other body in the world saying so. He seriously congratulated them on the readiness with which they had decided to assume the burden, and he would give every support in his power in order to carry out their wishes.

In alluding to the Committee's Report, His Excellency thought that it was very valuable and important to have a local Board of Management for the College, but that it was equally important to link the Universities and educational bodies at home to the College, for they would thus have the advantage of drawing upon the resources of those bodies as regards scientific knowledge and personnel, which would secure a constant flow of fresh blood, and keep them alive and up-to-date.

A few days later, at a meeting of the Trinidad Chamber of Commerce, the following resolution was moved by Mr. Cipriani and seconded by Mr. Rae :—

That this Chamber approves and endorses the action of the Agricultural Society in passing a resolution at their last meeting, welcoming the proposal contained in the Report of the Tropical Agricultural College Committee, which, if carried out, would undoubtedly be of very great advantage, and that the Government shall levy such taxation as they consider necessary for the maintenance and adequate support of the College here.

The resolution was unanimously agreed to.

At a meeting of the Legislative Council of Trinidad on April 9, the following resolution was moved by the Hon. A. H. Cipriani :—

That this Council approves the recommendation of the Committee, appointed to consider the desirability of establishing a Tropical Agricultural College in the West Indies, that such a College be established in Trinidad ; and recommends that the initial sum of £50,000 required for its establishment be raised by a tax on agricultural produce during the years 1921 and 1922.

The resolution was unanimously agreed to.

Cotton Seed for Planting in St. Vincent.—From information received from Mr. T. P. Jackson, Agricultural Superintendent, St. Vincent, it appears that cotton seed for planting ordinary cotton during the coming season will be obtained by cotton planters from Ratho Mill estate. The cotton grown on this estate has originated from careful selection made at the Experiment Station. In the crop just past the seed-cotton of this selection produced 28 per cent. lint, and also gave a heavy yield per acre.

With regard to the growers of what is known as superfine cotton, they will make their own arrangements for seed supplies.

In the Report on the Agricultural Department, Antigua, for the year 1918-19, it is stated that plants were raised from seeds of *Cytisus stenopetalus* which had been obtained from Dr. V. G. Perez of Teneriffe, through the Imperial Commissioner of Agriculture. The plants flowered when they were about 12 inches high. It seems probable, however, that the climate of Antigua is too hot and dry for them, as since flowering the plants appear particularly unhealthy, and many of them have died.

GLEANINGS.

The best Toggenburg goat in the recent London Dairy Show was 'Leazes Haddon,' but the champion milch goat of the show was a cross-bred Anglo-Nubian Swiss, with a yield of a little over 4 quarts per day for the two days of the show. This yield is better than many a cow gives in the West Indies. (The *Journal of the Jamaica Agricultural Society*, January 1920.)

The common palm fans, according to a note in the *Wealth of India*, November 1919, are the trimmed leaf and leaf-stalk of *Livistona chinensis*, a small palm which is a native of the southern tropical districts of China. It requires about seven years for the palms to grow to the size necessary to produce good fan leaves; after that they furnish an annual crop indefinitely, the Chinese state for hundreds of years.

It is suggested in the *Proceedings of the Agricultural Society of Trinidad and Tobago*, January 1920, that the Botanical Department should experiment in the cultivation and preparation of the Trinidad variety of vanilla. The large size of the vanillas growing in the Trinidad forests, and their quality, which appears good, seems to lend an inducement to experiments in that direction.

In the *Journal of the Jamaica Agricultural Society*, January 1920, it is recommended that in planting sweet potato slips the leaves should be first picked off. It is stated that defoliated slips make new growth more quickly than when the leaves are allowed to remain on and wither. Another point is that by defoliating potato cuttings before transporting from one place to another, weight, and therefore expense in transit, are saved. It might be interesting for planters in other islands to test this advice.

It is stated in the *Wealth of India*, November 1919, that under some extraordinary and very favourable circumstances coco-nut trees may come into bearing at the end of the fourth year in India, but generally they do not do so before the eighth year, or even later. It must however be noted, that this depends largely on the nature of the soil, the kind of treatment the plant receives in the way of manuring and other operations, the available supply of moisture, etc. The tree gives its maximum yield at about its twenty-fifth year, and continues to do so until it attains the age of fifty or seventy years. There are a few cases in which a tree has been known to give a good yield when over one hundred years old. In the West Indies, however, coco-nut trees are usually in full bearing much earlier.

The cultivation of the coco-nut palm has been largely extended in the colony of Trinidad and Tobago during the past six or seven years. The January number of the *Proceedings of the Agricultural Society* of that colony, states that over 31,000,000 nuts were shipped in 1919, as compared with 22,000,000 in the year before. High prices were also obtained for the crop.

Colonial Reports—Annual, No. 1025, which is a Report on the island of Cyprus for the year 1918-19, notes that, in view of the enormous depredations caused by sparrows in regard to the cereal crops of the island, it has been found necessary to take steps to control and, if possible, reduce their number. With this end in view a campaign was started in 1917 for the collection and destruction of sparrows' eggs, which has proved moderately successful in limiting their numbers. During 1918 over 14,000 eggs were collected and destroyed.

A report of Dr. C. A Browne, Chemist in Charge of the New York Sugar Laboratory, states that a slight improvement was noted in the quality of the raw sugars tested during 1919. The losses, however, from deterioration in storage were very great. According to comparative analyses made at the laboratory, the loss during storage in Cuba alone is estimated at over $5,000,000, and, when there is added to this sum the losses from deterioration in transit, and in storage after delivery, the total losses from this cause probably approximate to 1 per cent. of the total value of the Cuba crop. (*Facts About Sugar*, February 28, 1920.)

Colonial Reports—Annual, No. 1017, deals with the colony of the Falkland Islands and its Dependencies, for the year 1919. It is stated that the face of the country is covered in the main with a coarse yellowish grass capable of feeding cattle or of maintaining sheep of a hardy cross-bred variety. Although an attempt was made in the early days of the colony to devote the land to cattle breeding, sheep farming is now, and has been for many years, the sole industry of the Falkland Islands. Practically the whole country has been split up into a number of farms for this purpose, the freeholds of which have been, or are in process of being purchased from the Crown.

The first plant in New Zealand for the extraction of oil from kauri-gum peat has lately commenced operations. It is estimated that 4,500 gallons of oil will be turned out per week, the production being motor spirit, a valuable solvent oil, a turpentine substitute, and paint and varnish oils. The process of extracting the oil is very similar to distilling oil from shale. It is possible that the extracting of oil from this peat will become a most important industry in New Zealand, since there are thousands of acres of this swamp land in the North Auckland Province, and each acre contains many thousands of dollars worth of oil. (*Weekly Bulletin*, Department of Trade and Commerce, Canada, March 8, 1920.)

Last season, the total production of Pima cotton in Arizona and California equalled the production of Sea Island cotton. The total amount used in manufacture in the United States of long staple cotton, either Old World Egyptian or Sea Island cotton, in the five years previous to the war, was 275,340 bales annually, of which 78,650 bales of 400 lb. were Sea Island. This year it is assumed that from 45,000 to 50,000 bales of Pima American-Egyptian cotton will be produced, while there will only be some 15,000 bales of Sea Island cotton. (*The Board of Trade Journal*, February 1920.)

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended March 20, 1920, is as follows:—

ISLANDS. Since our last circular report of February 24, our market has remained very quiet. The offering stock has been small, and consists principally of small crop lots of Extra Fine, which are firmly held at prices ranging from $1·30 to $1 50.

There is a limited supply of Fully Fine remaining unsold, very firmly held at $1·05 landed. This cotton looks relatively cheap, and will be taken by the trade sooner or later.

We quote, viz.:—

Fine to Fully Fine Islands, @ $1·05, f.o.b. and freight.

Of this crop there is now left unsold less than 100 bales.

GEORGIAS AND FLORIDAS. The offerings on the Savannah market have been very small, and firmly held at quotations. The demand has been general, resulting in sales of cotton throughout the interior markets, and a large lot of about 700 bales held in warehouse in Jacksonville, owned by merchants in Florida. This buying has been on account of the Northern Mills, and the recent large sales have swept the markets of all offerings which holders were willing to sell at quotations.

The stock that is left unsold is much reduced, and held off the market for still higher prices.

We quote, viz.:—

Average Extra Choice @ $1·04, f.o.b. and freight.

The exports from Savannah since February 14 have been, to Havre 254 bales, Northern Mills 1,705 bales, Southern Mills 465 bales, and from Jacksonville to Northern Mills 278 bales.

In our next circular we will endeavour to give some information as to the probable acreage that will be planted this coming season in South Carolina, Georgia and Florida.

To-day the United States Census Bureau made its final report of cotton ginned to March 1, as follows:—

South Carolina	3,445 bales		
Georgia	683 bales	making a total of	6 907 bales
Florida	2,779 bales		
against last year,	51,389 bales	Total crop	44,380 bales.
,, 1918	92,501 bales	,, ,,	88,174 bales.
,, 1917	117,544 bales	,, ,,	113,109 bales.
,, 1916	91,920 bales	,, ,,	85,278 bales.

EMPIRE COTTON GROWING.

As is pointed out in *United Empire*, March 1920, for twenty years the British Cotton Growing Association has been doing its best to educate the Empire to a proper comprehension of the danger which lies in the situation that Great Britain has been dependent on the United States for 85 per cent. of its cotton supplies, especially considering that every year the United States itself consumed a larger proportion of its own cotton. In fact, British policy in regard to Empire cotton has been as short sighted in the past as in regard to Empire sugar. Now, however, the Government have come to the assistance of the cotton growers of the Empire.

The Board of Trade Journal, February 26, 1920, in reference to this matter, states that Sir Auckland Geddes, President of the Board of Trade, delivered an address at a luncheon recently given by the Manchester Chamber of Commerce. Referring to the need for increasing the future supply of raw cotton, he expressed gratitude to the Empire Cotton Growing Committee for the work they had accomplished. Their report had been discussed by the Cabinet, and he was able to announce that the Government had approved in principle of the recommendations of the Committee, and had decided forthwith to ask Parliament to vote a grant of £10,000 a year for five years to enable the Committee to develop its work. Every department of the State would be pleased to do all that was possible to help in the development of this work. It was obviously impossible for the Government to pledge itself in detail as to what precise action it would agree to take, but so far as it lay in their power, they would give the fullest possible report to this great scheme of Empire development.

Articles in the leading English journals convey the impression that Lancashire is ready to raise a trade fund up to a quarter of a million sterling by a levy on every bale imported, and, if necesary, on every spindle employed. The colonies selected for cotton cultivation might also reasonably be expected ultimately to contribute out of the profits which would accrue to them from the development of the industry. Thus the Imperial Government, the cotton spinners, and the colonies must share in the burden of making the Empire self-supporting in the matter of cotton.

THE ORIGIN OF MAIZE.

Among plants, most of the cereals have so long been cultivated that the origin of them from any existent wild plant is a matter of dispute among botanists. Maize, for instance, is known to have been cultivated by the aborigines when America was discovered by the Europeans five hundred years ago. Various views concerning the possible origin of this cultivated plant have been put forward, one being the theory of Mr. Collins which is noticed in *Nature*, February 12, 1920. This theory, based on breeding experiments and morphological comparisons, is that the cultivated race of maize (*Zea Mays*) arose as a hybrid between the Mexican 'teosinte' (*Euchlæna* sp.) and some unknown grass belonging to the family of Andropogons. Quite recently a Japanese botanist, Mr. Y. Kuwada, has studied the chromosomes of maize and its relatives, and his conclusions support cytologically Mr. Collins's hypothesis.

Maize, as well as Euchlaena and Andropogon, is found to have ten pairs of chromosomes, but those of Euchlaena are longer than those of Andropogon, while in maize they are found to be of different lengths, a pair frequently being composed of a longer and a shorter chromosome. From this it is concluded that maize is hybrid in origin, the two types of chromosomes being traceable, as in certain experimentally produced animal hybrids. Some races and individuals of sugar-maize are found to have eleven or twelve pairs of chromosomes, which is attributed to cross-segmentation of one or two pairs. It would appear that in the origin of the many known varieties of maize, a considerable number of which were grown by the natives in different parts of the American continent, hybridization and mutation may have gone hand in hand.

PLANT DISEASES.

MOSAIC DISEASE OF SUGAR-CANE IN TRINIDAD.

At a meeting of the Board of Agriculture of Trinidad, held on March 18, Mr. W. G. Freeman, the Director of Agriculture, presented a memorandum by Mr. C. B. Williams on the presence in Trinidad of the Mosaic disease of sugar-cane. Most of the memorandum is reproduced below. It should be added that since the date of the meeting specimens sent to the Bureau of Plant Industry at Washington have been certified by Dr. Brandes to exhibit the symptoms of the Mosaic disease.

About two years ago a plot of canes of the variety D. 3956 at St. Augustine was noticed to have the leaves streaked with pale yellowish green. A year later the same condition was apparent, if anything more pronounced, but nothing similar was noticed on the neighbouring beds.

Towards the end of last year a close search was again made at St. Augustine, and it was found to be present on many of the beds. Specimens were exhibited at the Board of Agriculture, but the condition was new to all concerned in sugar work.

It was decided, as a precaution, not to send out from St. Augustine any further plants from the affected plots, and a close watch was kept on them.

About three weeks ago an examination revealed the fact that young plants grown at St. Augustine from cuttings taken from infected beds were coming up already with the diseased condition of the leaves.

As similar cuttings had been sent out from St. Augustine from September to November last year, a number of these were followed up to the estates where they had been sent, and examined in the field. In every case that has been so examined plants have been found affected. So that if it is a disease a number of centres of distribution have been started.

Almost every variety grown at St. Augustine is now infected, and it has been found on the following varieties in cuttings sent out: B.H. 10 (12), B. 6308, B. 6388, B. 3922 and Ba. 6032. It has been found also in plants grown from cuttings sent out nearly a year ago from St. Augustine.

It is not absolutely certain at present that the condition found here is identical with the 'Mosaic disease', but there are very strong reasons for suspecting that it is so. Specimens have been sent to the United States, but up to the present no reply has been received.

In the meantime it is safe to take precautions while possible.

I suggest that the following steps should be taken immediately:—

1. To proclaim the disease under the Plant Protection Ordinance.

2. To follow up all the cuttings sent out from St. Augustine and to destroy all those showing any signs of the disease.

3. To send out no further cuttings from St. Augustine at present.

4. To plough up all the diseased beds at St. Augustine, and to replant with healthy cuttings.

SILAGE INOCULATION.

In Number 467 of the present volume of the *Agricultural News*, a summary of the discussions and investigations carried on by certain experimenters in Italy and elsewhere, on the utilization of selected ferments in ensilage, was reproduced from the *Agricultural Gazette* of Canada, January 1920. Preference was given in that summary to what is known as the 'lactic silo', the results giving a new turn to the preparation of ensilage, reducing it to a process of preservation by lactic fermentation, such as frequently occurs in nature. As the result of these experiments, it was proposed that a supply of selected ferments should be distributed among experiment statement workers and farmers, all necessary precautions being observed, and instructions given as to the best methods of using the ferments, and the bacteriological and chemical control necessary to ensure the best results.

In connexion with the foregoing, it appears from an article published in the *Quarterly Bulletin* of the Michigan Agricultural College Experiment Station, November 1919, recently received at this Office, that an article on bone-dry silage appearing in the *Country Gentleman* of August 23, 1919, as to the efficacy of lactic acid bacteria which produce such desirable results, has led to the application for cultures to the Bacteriological Section of the Michigan Experiment Station. These applications have been refused, on the ground that the status of silage inoculation in this station and in the other Experiment Stations of the United States has not reached the point where this method of procedure can be recommended to the farmer. When silage inoculation can be recommended by any Experiment Station, such recommendation, it is stated, will be based on the successful results of a large series of experiments both on a small and a large scale.

Moreover, it is contended that the article above referred to, gives an erroneous idea to the layman, when it mentions the bacteria used for inoculating silage as 'lactic acid bacteria', as to the layman this immediately suggests the bacteria which ordinarily cause the souring of milk. Emphasis is placed on the fact that there are many kinds of lactic acid producing bacteria; for instance, one of the bacteria producing pneumonia, and another one involved in blood poisoning are of this type It is pointed out that from bacteriological analyses made by several investigators not only in the United States, but in Italy, France, and other European countries, the types which predominate in the fermentation of silage, and which have been used successfully for its inoculation, are not the ordinary milk souring germs, but lactic acid-producing bacteria having quite different characteristics; in fact, one prominent type found in fermenting silage is the type most concerned in the normal fermentation of cucumber pickles. The ordinary sour milk-producing germs may be present in silage, however, and do their bit toward producing the acid which is so essential in its successful preservation.

The nature of the fermentation processes in the silo, which may not be generally understood, is briefly described, and is here reproduced, as of general interest

When chopped corn forage is tightly packed into a nearly air-tight silo with plenty of moisture present, fermentation begins at once, which is evidenced by a slight rise in temperature and the evolution of carbonic acid gas (CO_2). The small amount of oxygen present at first is used up early in the fermentation process or driven out by the CO_2, thus the fermentation continues under anaerobic conditions (i.e. without air). This fermentation is a mixed one at first, both an alcoholic and an acid fermentation being present, due respectively to yeasts and bacteria of different kinds. In a short

time, however, in the normal fermentation the acid-producing bacteria gain ground, and the acid thus produced checks the development of many microbes which cannot withstand amounts of acid. The acid formed is largely lactic acid (the acid of sour milk), but considerable quantities of acetic acid (the acid of vinegar) and other organic acids are also formed from the sugar present in the silo-producing bacteria very closely resembling *Bacillus botulinus*, the toxin-producing organism of human food poisoning or 'botulism', have been isolated from silage which has caused poisoning in horses and cattle. The reason that poisonous silage has practically always been mouldy is quite evident, and the reason that the moulds were suspected of causing the silage to be poisonous is always quite evident; mould growth can be seen readily, while the presence of toxins can only be determined by tests on animals experimented with.

Briefly then, it is to be remembered that the preservation of silage depends on the rigid exclusion of air from all portions of the silos, and that ordinary silage, e.g. corn, when is well packed in the filling process, both in the centre and around the edges, will undergo a perfectly normal fermentation, as the necessary germs are practically always present. Spoilage can then take place only at the surface of the silage, and can be kept there to some extent by various means known to the farmer of excluding the air, such as covering with shavings, sawdust, sowing to oats, etc. The ideal way to accomplish this would be by hermetically sealing the top of the silage in some way each time a layer of silage is removed. At the present time this is practical, however, only on a small experimental scale. As the farmer becomes familiar with the requirements of the silage fermentation process, his ingenuity will develop methods for accomplishing the best results.

PRESERVING DUNKS.

It is not a euphonious name, but 'dunk' is the West Indian name of the fruit of the tree *Zizyphus Jujuba*. In California, where some attention is being paid to the cultivation of superior varieties imported from China, it is called more appropriately 'jujube.'

A small round variety is naturalized in Barbados, and is found also in some of the Northern Islands. The fruit of this variety cannot be said to be delicious when eaten ripe, but the possibilities of it when preserved seem to be worth attention. In the *California Cultivator*, January 24, 1920, the following recipe for candying the jujube or dunk is given, which appears worthy of experiment.

The fruit should be dealt with as soon as possible after being picked, while firm and unrinkled.

Make a syrup by dissolving 1lb. of sugar in ½ cup of hot water.

After washing the fruits in cold water, place them in the syrup, and simmer over fire for two hours, but do not allow the syrup to boil up, or the skins of the fruit will split. At the end of the simmering process remove the fruits from the syrup, drain them, and place them on plates in the sun to dry. As soon as no longer 'sticky'—usually about three days—the fruit should be pierced many times with a large steel needle.

Again place the jujubes into syrup, and boil slowly from ten to twenty minutes; then remove the fruits from syrup, place them on a plate, and dry them in the air and sun for one or two days, according to weather conditions.

It is advisable, if the candied fruits are to be kept for any length of time, to wrap them in oiled paper.

WEST INDIAN PRODUCTS.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S., has forwarded the following report on the London drug and spice markets for the month of February:—

Business in the London produce markets during the month of February has shown little or no change, either in the general tone, or in the bulk of products brought forward, since our report for January. Towards the end of the month however, it was reported that a fair amount of business, chiefly with an upward tendency, had been conducted during the closing week. The following are some of the principal details.

GINGER.

At the first auction on February 5 it was stated that Jamaica ginger was being exported in bulk to the United States at 100*s.* per cwt. At this same auction, for good sound washed rough Cochin, 100*s.* per cwt. was asked, and for more or less wormy, 65*s.* to 75*s.* was wanted. Some sales of Sierra Leone, it was stated, had been made in Liverpool at 60*s.* per cwt. At the close of the month the following statement was made in the *Chemist and Druggist*: 'High prices continue to be paid for washed rough and Calicut, and it is predicted that, unless anything unforeseen occurs, 100*s.* will have to be paid for these descriptions. The situation appears to be controlled by the increasing consumption in the United States. Spot stocks of Jamaica are now very scarce, with nothing available below 120*s.* to 130*s.* for good bold, and 100*s.* for small dark, slightly wormy. Prospects point to Jamaica going still higher, as there is still a large American demand.'

PIMENTO AND SARSAPARILLA.

Pimento has been in good demand throughout the month at 6*d.* to 6¼*d.* per lb. At auction on February 12 sarsaparilla was represented as follows: grey Jamaica 31 bales, of which 22 bales found buyers at 3*s.* 7*d.* to 3*s.* 9*d.* for fair; and for 14 bales of fine fibrous 3*s.* 11*d.* to 4*s.* was paid; 13 bales of Lima-Jamaica were disposed of at 2*s.* 6*d.* per lb.; 26 bales of native Jamaica and 20 bales of Mexican were also offered, but failed to find buyers.

KOLA, CITRIC ACID, LIME JUICE, LIME OIL, ANNATTO SEED, TAMARINDS AND CASSIA FISTULA.

At auction on the 12th of the month as many as 485 packages of kola were offered, only 28 of which were sold. For 26 packages of fair West African quarters, 6½*d.* per lb. was paid. The remaining 2 bags of bright West Indian were disposed of at 6*d.* per lb. It was reported at auction on the 5th. of the month that the recent heavy export trade with America in citric acid had considerably reduced the home supply, and limited quantities only could be obtained at from 4*s.* 9*d.* to 5*s.* A week later, 5*s.* 3*d.* to 5*s.* 6*d.* was asked. At auction on the 12th of the month lime juice was represented by 33 packages, but none was sold. At the last auction on the 26th 3*s.* 6*d.* per gallon was asked for good raw West Indian. Three packages of West Indian oil of limes were offered at auction on February 12, but failed to find buyers. At auction on the 12th of the month annatto seed was represented by 57 packages, but there were no buyers. At the same auction, 84 packages of East Indian tamarinds were offered, but none sold. At the last auction on the 26th, Cassia Fistula was represented by 85 packages from Holland, 185*s.* per cwt. being the price asked.

MARKET REPORTS.

London.—The West India Committee Circular, March 4.

Balata—Venezuelan Block, no quotations ; West Indian Sheet, 4*s.* 5½*d.*
Beeswax—No quotations.
Cacao—Trinidad, 130*s.* to 140*s.* Grenada, and St. Lucia, 130*s.* to 134*s.* 6*d.* Dominica, 122*s.* to 134*s.* Jamaica, and St. Vincent, no quotations.
Copra—£73, c.i.f.
Honey—No quotations
Lime Juice—Raw, 3*s.* to 3*s.* 6*d.* ; Concentrated, no quotations.
Pimento—6⅛*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T S. Garraway & Co., April 14,

Arrowroot—$9·00 per 100 ℔. duty paid.
Cacao—No recent sales.
Coco-nuts—$52·00 husked nuts.
Hay—Sales at $7·00.
Onions—Lottings at $17·80.
Peas, Split—No quotations; Canada, Market bare.
Potatoes—$7·00.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, February 24.

Bay Oil—28*s.* 6*d.*
Lime Oil—7*s.* for West Indian distilled, and 16*s.* for hand-pressed.
Orange Oil—West Indian, 28*s.*

Trinidad.—Messrs. Gordon, Grant & Co., April 7.

Cacao—Venezuelan. $28·50 ; Trinidad, $25·50 to $26·00.
Coco-nut Oil—$2·40 per gallon.
Coffee—Venezuelan, 25c. per ℔.
Copra—11½c. per ℔.
Dhal—No quotations
Onions—$15·00 per 100 ℔. Light stocks.
Peas, Split—$10·00 per bag.
Potatoes—English, $8·00 per 100 ℔.
Rice—Yellow, $12·50 to $13·00. White, $14·00 per bag.
Sugar—No sales made.

New York.—Messrs. Huth, Gillespie & Co., Inc. March 23.

Cacao—Caracas, 22¼c.; Grenada, 19½c. to 20c. ; Trinidad, 20¾c. to 21c. ; Jamaica, 17c. to 18c.
Coco-nuts—Jamaica selects, $65·00 per M; Trinidad $65·00 per M; culls, Jamaica, $35·00 ; Trinidad $35·00 per M.
Coffee—Jamaica, 18c. to 24½c. per ℔.
Ginger—23c. to 26c. per ℔.
Goat Skins—Jamaica $1·50; Antigua and Barbados $1·45 ; St. Thomas and St. Kitts, $1·45
Grape Fruit—Jamaica, $2·50 to $4·00.
Limes—$7·50 to $8·50
Mace—38c. to 40c.
Nutmegs—26½c. to 27c.
Oranges—$6·00 to $7·00.
Pimento—8½c. per ℔.
Sugar—Centrifugals, 96°, 10¼c. c. & f. ; Muscovados, 89°, No quotations. Molasses, 89°, No quotations.

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AGENTS FOR PUBLICATIONS OF THE IMPERIAL DEPARTMENT.

London: Messrs. Dulau & Co., Ltd., 34-36, Margaret Street, Cavendish Square, W.
West India Committee, 15, Seething Lane.
Barbados : Advocate Co., Ltd., Broad Street, Bridgetown.
Jamaica : The Educational Supply Company, 16, King Street, Kingston.
British Guiana : The Argosy Co., Ltd., Georgetown.
Trinidad: Messrs. Muir-Marshall & Co., Port-of-Spain.
Tobago: Mr. C. L. Plagemann, Scarborough.
Bahamas: Mr. N. D. Sands, Board of Agriculture, Nassau.
Grenada: Messrs. Thos. Lawlor & Co., St. George
St. Vincent: Mr. Floris Simmons, Experiment Station.
St. Lucia: Mr. R. W. Niles, Botanic Station.
Dominica: Mr. J. R. H. Bridgewater, Roseau.
Montserrat: Mr. W. Robson, Botanic Station,
Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre,
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 801, Yonge Street, Toronto

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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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The Art of Agriculture.

OF late there has been a strong tendency to emphasize the necessity of paying more attention to science, and to insist on the need for the application of science to industry. This aspect has found application in agriculture as in a great number of industries, and its effect has been good and useful. But from consideration of certain phases which are arising, one is led to consider whether, in agricultural matters, there is not an element of danger in this, unless very great care is exercised in preserving a balance of interests. Agriculture is an art, in which many, indeed most, sciences play a part. It has been a function of public service in recent years the world over to provide means of applying science to agriculture, and this has been one of the main functions of the agricultural departments which now form part of the machinery of administration of every modern State.

That the sciences related to agriculture have preponderating consideration in the work of agricultural departments, arises largely from the fact that the acquisition of expert knowledge of any science involves close application and prolonged study. The exponents of the science must be specialists, to be fully efficient. But only the application of certain problems or aspects of the case presented by specialists is required at the hands of farmers and planters; they cannot afford the time or energy required to become familiar in great detail with even one or two of these sciences. So we have the specialists of the agricultural departments formulating their knowledge into a shape which can be applied by the farmers and planters, and, with intelligence and close co-operation, coupled with frequent intercourse between agriculturists and scientists, this aspect suffices; this plan is indeed the most economical of effort, and productive of results. It is a good case of wise division of labour.

There is danger, however, that this aspect of the work of agricultural departments should create wrong impressions, and lead to an unbalanced form of thinking. The thoughtful farmer or planter may unconsciously receive a bias in the direction of thinking that these sciences and their application, to which the agricultural departments are constantly directing his attention and offering him help and guidance, constitute the main function of agriculture.

There may arise a feeling that the control of pests and diseases, the study of varieties of crops, attention to certain chemical aspects of crops or soils, constitute the main duty of farming. There is danger lest all that pertains to agriculture as an art may be relegated to the background, because the specialists of agricultural departments have so little to say about it.

That they have so little to say is because they have, as a rule, so little opportunity of acquiring knowledge of the art, or means of practising it: this aspect of the matter has been left mainly to the farmers and planters themselves, particularly in these West Indian colonies. The agricultural departments were created mainly to bring within the reach of the planters specialist knowledge, which otherwise they could get with difficulty, or not at all. Knowledge of much that concerns the working of the soil, the use of implements, the planting of crops and their tending, the management of labour, the hundred and one things which go to the daily work of a farm or plantation, is acquired by the farmer or planter during the early stages of his initiation into the work of the farm or plantation, and is added to throughout his life-long experience. He acquires knowledge of farming as an art; the application of scientific principles is helpful and necessary, but without a proper acquirement of the art, the application of fragmentary scientific knowledge is of little use. In this way the faddist is developed.

It may be suggested that it would be well if the agricultural departments could supply instruction in the art of farming, as well as provide scientific information for application in farming. So, doubtless, it would, but consideration will show that this presents difficulties. Such work is best relegated to the agricultural college, which should have facilities for instruction in farming arts; but even a well appointed college will leave much to be acquired by study and experience after the college course is finished.

It may be suggested that the agricultural departments should be furnished with land on which actual farming operations could be carried out by way of demonstration and instruction. As has been said, there are difficulties. In the first place, the cost of an adequate institution of this kind would be beyond the resources of most of the West Indian communities There are also other aspects which present difficulty. When such institutions are under discussion, there is a tendency to introduce two aspects of the case: the work of experimenting to ascertain what methods are best, and the work of demonstrating, to show how these best methods can be applied. If the work is to be experimental, then it is not likely to be commercially remunerative; at any rate the idea of making a profit must be entirely subsidiary to that of acquiring knowledge. Hence experiment stations are seldom places where the best methods of agriculture can be demonstrated. On the other hand, it seldom happens that a farming institution, run on the basis of a model farm, proves as remunerative as may be expected. As the element of gain is the one which has large consideration, such a farm runs the risk of being discredited as a model of instruction for young farmers. So the acquiring of knowledge of the art of farming under actual commercial conditions seems to offer the best chances of success, though it must be admitted that a good deal might be done to improve matters in this connexion.

A little thought will show that it would not be an easy matter to establish in one of the smaller colonies, a model farm for the guidance of planters generally, or the instruction of pupils, unless such a thing were connected, and then even in a modified form, with a teaching institution in the nature of an agricultural college.

Furthermore, the most remunerative methods in actual practice are not those which might commend themselves to the management of a model farm, or one run for demonstration purposes. Thus it happens that model farms frequently fail to pay.

There is, however, a movement in the West Indies in the direction of establishing farms or plantations where the arts of agriculture are demonstrated. Something of this kind is being done in connexion with the Government cacao plantation at River estate in Trinidad, and good results are being obtained. Similarly, the Lime Experiment Station at Dominica is affording good and instructive results. The creation of the large-scale Sugar Experiment Station in British Guiana is, no doubt, a move in a similar direction. These are special efforts in special circumstances, and may not be capable of general extension to smaller colonies.

The main object of these remarks is to draw the attention of practical planters to the fact that they must give increased consideration to those practical aspects of farming which come immediately within their grasp—those matters which constitute the art of farming, as distinguished from the application of scientific knowledge to definite problems which arise in the practice of the

art—such special matters as the means of combating a pest or a disease, or the selection of a good type of sugar-cane, or the best type of cotton seed. The agricultural departments can only be partial guides, even though they make efforts to embrace a knowledge of the art of farming. This art the planter can and must acquire through practice, though the workers of the agricultural departments can, and do very frequently, give him advice and assistance in matters which are rather those of an art than a science.

The nature of the work, and the duties of the agricultural departments may have tended to create a somewhat unbalanced outlook, for they naturally have regard to scientific problems, while the art of farming is taken for granted. It is for the planters to improve their art, and for the agricultural departments to extend and deepen their science.

THE DWARF COCO-NUT.

In an article in the *Agricultural News*, December 27' 1919, on the races of the coco-nut palm, it was pointed out that it might be important if careful investigation could be made with regard to the varieties of coco-nuts best suited for planting purposes in the West Indies.

In the *Agricultural Bulletin of the Federated Malay States*, September and October 1919, a description is given of a variety called the dwarf coco-nut, which, if nuts could be procured, would seem well worthy of experimenting with in these islands. Much of the article referred to above is reproduced below :—

The dwarf coco nut, known in the Malay peninsula as 'nyiur gading' is remarkable for its early fruiting, palms only 10 feet high bearing abundant fruits touching the ground. The young palm, grown under good conditions, starts to flower in its third year, and produces ripe fruit in about nine months from the appearance of the flower-spike The initial flower spikes contain only male flowers, but other spikes occurring in rapid succession, are larger, and bear an increasing number of female flowers also. On a spike from a six-year-old tree 200 young female flowers have been counted, while trusses of fruit from similar trees have been found with as many as fifty-five ripe nuts.

The dwarf coco-nut is generally of a bright yellow colour, but there are, besides, a distinct brick-red variety, a green variety, and a number of intermediate colours which might be ranged as ivory yellow, golden yellow, orange, brick-red, green bronze, and deep green. The flower spikes, leaf bases, and leaf ribs correspond in colour with the fruit, giving the compact trees a very handsome appearance. Again there are semi-tall trees of these different colours, which are later in coming into bearing, having slightly larger nuts, and are less prolific than the true dwarf.

The dwarf yellow strain appears to be the most prolific, whilst the other varieties vary proportionately in their productiveness, and also in the shape and size of the nut, and are evidently the outcome of cross-fertilization from original types or mutants.

A full-grown leaf of the 'nyiur gading' measures only 12 feet from base to tip, whilst an average ripe nut measures $32\frac{1}{2}$ inches × 24 inches in circumference. The nut has an average amount of fibre, a thin shell, and, proportionately with the big nut, a good thickness of white kernel.

This 'meat' is said by the Malays to be richer in oil and sweeter in taste than that of the big coco-nut, and it is therefore very popular with them for domestic purposes.

In 1912, 500 acres were planted with these dwarf nuts at Sungei Nipah estate, on the coast between Port Dickson and Sepang Point, and this is probably the only estate of dwarf coco-nuts in the world.

In the first year of production at Sungei Nipah, the crop from over 225 acres was 102,000 nuts, while in the second year it was 574,000 nuts, and in the third year it will probably be nearly a million. From these data the average yield for dwarf nuts may be predicted as follows :—

At the end of 4th	year =	1st	yielding	year = 10	nuts per tree
5th	,,	2nd	,,	30	,,
6th	,,	3rd	,,	60	,,
7th	,,	4th	,,	80	,,
8th	,,	5th	,,	100	,,
9th	,,	6th	,,	120	nuts per tree in full bearing.

These estimates, in face of yields from individual trees, will appear conservative, but there are many points which have to be considered when dealing with average yields, and no doubt, under ideal conditions, a much higher average could be obtained.

In making copra it has been found that the nut from a young tree is smaller than that coming later, and its kernel likewise thinner; while on heavy yielding trees the nuts are a little below the average in size; but 500 nuts to a picul of copra is a general average, which would be decreased somewhat later when more even nuts with thicker meat were obtained. With a leaf length of only 12 feet, it was found convenient to plant the palms 24 feet × 20 feet, which gave ninety trees to the acre, a number nearly double that required when planting big palms.

It will be evident, therefore, that with this planting there might be obtained, say, in the fifth year of planting 90, × 30 nuts = 2,700 nuts per acre. Likewise, in the ninth year 90 × 120 = 10,800 nuts per acre. Comparing this with the big coco-nut, which does not produce till after its fifth year, the crop might be estimated in the ninth year as forty-five trees with forty nuts, average 1,800 nuts per acre. With the dwarf trees there is the great advantage of easy and rapid picking, and inspection for beetles and other pests, though in manufacture one has to handle almost two and a half times the number of nuts per picul of copra; but this is not of so great consequence when working with newly devised methods and machinery for dealing with large quantities.

In connexion with the above, it may be mentioned that at a meeting of the Jamaica Agricultural Society, on January 7, 1920, the Secretary brought to the notice of the Board of Management the advisability of importing a variety of coco-nut from Fiji, the description of which is very much like that given above. This nut, which is called 'N'uleka' in Fiji, only makes a short tree; it bears on ordinary land and under ordinary conditions in five years, and the trees are said to carry immense crops—as many as 400 nuts per tree, which are never very large and yet are not very small.

SUGAR INDUSTRY.

ONE CUBAN CANE SUGAR COMPANY.

In the *Cuba Review*, January 1920, there is published the Annual Report of the Cuba Cane Sugar Corporation for the year ended September 30, 1919 which shows the magnitude of the Cuba sugar industry. This company, which is an American one, controls seventeen different factories, located partly in the western district of Cuba and partly in the eastern. Much of this report is reproduced below as a testimony to the fact that Cuba must for a long time control the cane sugar markets.

The report states that it is to be regretted that the percentage of sucrose in the cane was unsatisfactory, being lower at nearly all the plantations than in any other year since the incorporation of the company.

The variations in the sucrose are due to climatic conditions, and beyond human control. This decrease in sucrose was not limited to the plantations of the company, but prevailed throughout Cuba.

The actual quantity of cane ground by the company's mills was as follows:—

Western estates	3,430,012 tons
Eastern „	2,168,164 „
Total	5,598,176 tons

In addition to the 3,430,012 tons of cane ground at the western plantations, there were sold to outside plantations 95,505 tons.

The total amount of cane ground at the factories for the year 1918-19 was 5,598,176 tons, which shows that the cane-supply of this one company exceeded the total amount of cane produced in the entire United States for that crop.

The average percentage of sucrose in the cane at the seventeen plantations for the four crops was as follows :—

1915-16.	1916-17.	1917-18.	1918 19.
13·87 per cent.	13·00 per cent.	13·31 per cent.	13·02 per cent.

The sucrose in the cane has not been high for the last three crops. Such continuously low sucrose in the cane is most unusual. In Cuba it is rare indeed to have low sucrose for so many consecutive years.

The sucrose content depends much upon the temperature and seasonable rains, but, above all, the cane needs cool and dry weather during the grinding season.

The total production of sugar for four years has been :—

Years.	Tons.
1915-16	452,035
1916-17	472,542
1917-18	521,328
1918-19	624,101

This production has been divided between the western and eastern estates as follows :—

	Western. Tons.	Eastern. Tons.
1915-16	372,589	79,446
1916-17	345,373	127,169
1917-18	351,742	169,586
1918-19	382,783	241,318

Attention is called to the enormous increase in cane for the eastern estates from 1916-17 to 1919-20, namely, over 1,600,000 tons. In order to obtain that additional quantity of cane, about 80,000 acres of timber land had to be cleared and planted in cane within the last three years.

The corporation owns 373,800 acres of land, and holds under lease—many of these leases being for long periods—231,000 acres of land. The total lands owned and leased amount to 604,800 acres.

The company is still carrying on experiments for the improvement of the cane seed, and mechanical devices for cutting the cane. It cannot be said that much has been accomplished in the improvement of cane seed, as years are required to obtain results. Considerable progress has been made in the development of the cane cutter which, however, is not yet a practical success, and also in improving the mechanical means for transporting the cane to the mills.

PLANTATION REFINED SUGAR DEVELOPMENT.

It is reported that several Cuban factories have already started to turn out their whole output in white sugar. This has probably been the direct issue of the report prepared by a special envoy of the Cuban Government on the condition of the European beet sugar industry. This envoy, Mr. H. J. de Mesa, having returned from an extensive tour of the European sugar districts, states his conviction that it would be a long time before the European beet industry will be a menace to that of cane sugar.

The latter part of his report, which is reproduced below, deals with the question of the possibility of cane sugar factories producing white sugar, and thus eliminating the profits at present accruing to the refiners :—

Most emphatically he calls the attention of the Cuban sugar producers to the fact that Europe wants white sugar.

White sugar must be made in Cuba. Europe (except England) is not prepared to refine, and does not wish to eat raw sugar. The French refineries are not prepared to refine Cuban raws. Before the war beet sugar came from Europe to America, and Cuba exported practically no sugar to Europe. Now, Cuba exports 1,500,000 tons to countries apart from the United States.

The refineries of the United States, for the first time in history, are exporting part of their product, and are actually organizing foreign departments which never existed before, preparing for the exports to Europe. Much Cuban sugar went to Europe through American refineries at a profit of millions of dollars to the Sugar Equalization Board, and after this Board ceases to exist, the profit will go to the refineries.

This profit, plus the saving of rehandling charge, should be secured by the Cuban producer. As he now has fuel oil, and as his furnaces and boilers, evaporators, vacuum pans and centrifugals are exactly such as a refiner must use, he only needs the addition of bone-black filters to make complete refineries of his raw sugar factories. To bring a Cuban raw sugar factory to a refining capacity would cost one-third of what a complete new refinery would cost.

Refined sugar direct from Cuba to Europe would save rehandling. The extra profit, after making all allowances for extra cost, would be nearer 3c. per lb. of sugar than 2c. It will also bring about a great advantage inasmuch as it would reduce the quantity of raws that weighs now on the American market) from 4,000,000 tons to 2,500,000 tons),

compels Cuba, in many cases, to make forced sales during the crop.

There are other processes of producing direct white sugars that command to-day very high prices. During the last crop in Louisiana a large percentage of the sugar produced was of this kind, and from it the planters reaped a large profit.

Almost any Cuban factory could be arranged to work one of these processes, and at but little expense. These near-white sugars will be in great demand in Europe, especially this year, and the difference in price between white and brown sugar will be entirely out of proportion to the actual cost of making white sugar.

It is evident, as is pointed out in the *International Sugar Journal*, February 1920, that the refiners, both British and American, have now a big problem to face. In normal times British refiners are not so dependent on Cuba as are the American refiners on the Atlantic coast, but it cannot be assumed that if Cuba is successful in producing white sugar in her own factories, the British sources of supply of raw sugar will not follow her example. The high price of sugar has provided sugar producers generally with the surplus of capital which will enable them to experiment in new processes, and before long Mauritius may not be the only British colony to turn out chiefly white sugars. The refiners may indeed be forced to transfer their interest to the centres of sugar production in the tropics. If the process of making and refining sugar in the same tropical factory were to vanquish the present procedure of making raw sugar on the spot, and then exporting this product for refining overseas, the refiners would be forced to shift their sphere of work to the scenes of cane cultivation, or else retire from the contest.

COMPOUND FERTILIZERS AND HOME MIXTURES.

A very sensible article on the above subject appeared in the *Fertilizer and Feedingstuffs Journal*, January 21, 1920. The author, 'Ceres', distinctly makes out his case in favour of the superiority of the former over the latter. Much of the article is reproduced below, as the subject of artificial fertilizers is one of perpetual importance to the agriculturist.

In all compound fertilizers there are combined two or three of the principal elements of plant food, as, for example, phosphates and nitrogen, phosphates and potash, and phosphates, nitrogen and potash. These are present in the compound fertilizer in varying proportions, and degrees of availability obtained from the different sources, which experience has proved to be most suitable for the requirement of the individual crop, after giving due consideration to soil and weather conditions.

It is, however, sometimes asserted, especially on the ground of economy, that agriculturists would consult their best interest by buying the separate materials and mixing them together for themselves. The following considerations will however expose the fallacy of this idea.

When a farmer applies 5 cwt. per acre of fertilizer, it only amounts to about one grain to every pound of soil to a depth of 9 inches, which is equivalent at most to less than half a grain of plant food to each pound of soil. It will therefore be understood of how great importance it is that a compound fertilizer be thoroughly combined or incorporated, and in such a fine powder that each pound of soil receives its equal proportion of the two or three elements of plant food present in the fertilizer applied.

There are two good reasons why a home mixture cannot be as valuable as one properly compounded in a factory. The first is a mechanical reason, the second is a chemical reason.

1. *Mechanical reason.*—If the materials were all equally fine and dry, and of about the same specific gravity, the variation in results would be very much lessened, but this is not the case. Different materials do not easily make a uniform mixture that will remain of constant composition. It is not reasonable to expect that the farmer can make a uniform mixture of the materials in the rough state usually supplied, by means of shovel and sieve on a floor, when the fertilizer manufacturer finds it necessary to employ costly machinery for mixing, grinding, and incorporating the ingredients to enable him to produce a fertilizer of constant composition.

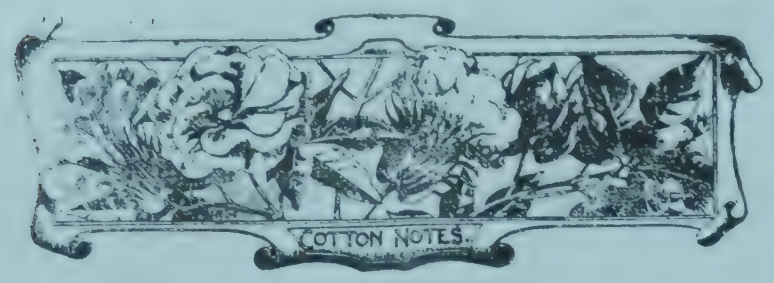
A home mixture, as usually prepared, is merely an association of materials, from which if 100 samples were taken, most probably ninety of them would not analyse in accordance with the prescription or formula used.

Contrast this with the procedure in a factory where the ingredients, after being weighed, are ground and thoroughly mixed together in suitable machines, and the resultant compound is placed in heaps when chemical action, facilitated by the heat engendered during the process takes place. The compound during the weeks and sometimes months in which it remains undisturbed, becomes 'conditioned', and loss in weight occurs. Moreover, before compounds are bagged and leave the factory, they are once more put through the process of grinding and blending, so that it is as certain as possible that they are thoroughly incorporated.

It surely will be realized from this description, that the process of compounding fertilizers in the factory is a far more thorough and expensive one than that of mixing ingredients by means of shovel and sieve. There is absolutely no comparison between them.

2. *Chemical reason.*—In all crudely made home mixtures a certain amount of chemical action is set up, hence the prescriptions usually state that certain ingredients 'must not be mixed' together, or the mixture must be 'applied immediately.' In chemically compounded, factory-made fertilizers, all chemical action and reaction which go to make good condition and availability have taken place before the goods leave the factory.

Vitamines.—Increasing attention is being paid to the question in organic chemistry as to the rôle played by vitamines in nutrition. In the Report of the Lister Institute for Preventive Medicine, for the year 1919, an account is given of the work done in connexion with the antiscorbutic accessory factor in common foodstuffs. Among the conclusions reached, it would appear that the juice of the lemon is superior as an antiscorbutic, to that of the lime. It has also apparently been founds historically that the 'lime juice,' originally employedd for the prevention of scurvy in the British Navy, was actually prepared from Sicily lemons. It is stated that the juice of the turnip or swede is an efficient antiscorbutic substitute for the juice of citrus fruits



A METHOD OF IMPROVING SEA ISLAND COTTON.

A paper was contributed by Dr. S. C. Harland, D.Sc., to the *West Indian Bulletin*, Vol. XVII, No. 4, on the improvement of Sea Island cotton in the West Indies by the isolation of pure strains. The author, after having discussed the results of three years' breeding work, sets forth some general considerations arising from the work as a whole. Much of this portion of Dr. Harland's paper is reproduced below.

In the first place, both in St. Vincent and in Montserrat, it has been shown that Sea Island cotton, as commercially grown, is composed of a mixture of distinct strains, which can be separated by self-fertilization and selection. Both from the point of view of yield and of the commercial value of the lint, these strains are of varying value.

Length of staple would seem to be one of the main factors in determining commercial value. Regularity of staple, which can be judged by estimation of available fibre, is probably largely influenced by amount and distribution of rainfall, and an island like St. Vincent, which usually has an even distribution of rainfall, will perhaps always produce a more valuable product than Montserrat or St. Kitts.

It must be obvious to all who are concerned with cotton breeding work, that the improvement of Sea Island cotton is a peculiarly difficult matter. Before a new strain can be recommended for cultivation on a commercial scale, it must be tested at all possible points. It must possess satisfactory physiological as well as morphological characters. As long as the attempted improvement of Sea Island cotton is carried on by the mass selection method, there is little danger of losing desirable, or of perpetuating undesirable, characters to any great extent. With the adoption of the pedigree selection method arises the possibility that a desirable character may be dropped out at any point through lack of knowledge as to its importance, and that an undesirable character may be obtained in a homozygous condition.

The work of Sea Island cotton breeding has now become a complex business, and if the work is controlled by those who are not thoroughly familiar with its difficulties, the results produced are quite likely to be disastrous.

In three years in Montserrat and St. Vincent, certain definite results have been achieved. When the whole series of results is scrutinized, it is clear that a good deal of work could have been saved at the outset, if definite ideas had been held as to what was really required. A type with a lint weight of 60 mg. has been obtained. It is now possible to set out a practical method for the improvement of Sea Island cotton which will give valuable results in a comparatively short time, and by which the dangers alluded to above as arising in a pure strain work are not likely to occur.

The method is as follows :—

1. From a commercial field of Sea Island cotton or from the F_2 of a cross between two Sea Island strains, select about 300 plants.

Examine the plants for the following characters :—

(a) Mean maximum of lint (on five seeds).
(b) Weight of lint per seed (on 100 seeds).
(c) Seed weight (on 100 seeds).
(d) Weight of lint per boll (on fifteen bolls).

No plant should be selected of lint length less than 50 mm., lint weight less than 47 mg., seed weight less than 130 mg., or lint per boll of less than 0·90 gm.

2. Grow all the selected plants in progeny rows of twenty plants in the following year. At the time when the first bolls are opening, make an examination of the rows, rejecting all rows which are undesirable from the general vegetative point of view. Bearing in mind the fact that number of bolls per plant is of the highest importance from the point of view of yield, a row may be rejected for the following reasons :—

(a) Greater susceptibility to the Angular leaf spot disease than its neighbours, (b) obvious liability to shedding of either bolls or buds, (c) inability to produce a good stand.

Gather a bulk sample of seed-cotton consisting of 200 bolls from each of the remaining rows. Record the characters as follows :—

(a) Lint length on twenty-five seeds.
(b) Weight of lint per boll.
(c) Weight of lint per seed.
(d) Seed weight.

The last three characters can be recorded by weighing the seed-cotton, and then weighing the lint, after hand ginning. The only test of the inherent worth of a plant is the average behaviour of its progeny and the results of the bulk sample test will enable the observer to eliminate all the poorer types. Select the best six rows and examine the characters of each plant in the same manner as stated in 1. No row should be selected with mean lint length of less than 48 mm., lint weight less than 50 mg., seed weight less than 130 mg, or lint per boll of less than 1·10 gm .After the rows have been examined, the best three should be self-fertilized.

3. Plant progeny rows in the next year of twenty plants, of all plants in the best three rows. Again at the fruiting stage eliminate any rows which are undesirable vegetatively, and examine bulk samples from the remaining rows as in the previous year. Select the two best rows from each group for examination of individual plants. At this stage the strains should be in a condition of relative purity, and either or both can be selected for propagation on a large scale.

The principles which are followed in the above method of selection may be summed up thus :—

1. Full advantage is taken of the great variation existing in commercial Sea Island cotton, and in the F generation of Sea Island crosses.

2. The bulk sample method of examination gives an approximately correct idea of the average behaviour of all plants in the row, thus enabling the observer to eliminate types which show themselves genotypically inferior.

3. Practical use is made of the correlations which exist between—

(a) Weight of lint per seed and weight of lint per boll.
(b) Weight of lint per boll and weight of lint per acre.
(c) Weight of lint per seed and weight of seed.

4 The unit of selection is not the individual plant, but the mean of its progeny.

DEPARTMENT NEWS.

Sir Francis Watts, K.C.M.G., Imperial Commissioner of Agriculture for the West Indies, returned to Barbados in the R.M.S. 'Chaudiere' on April 30, from St. Kitts.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. During the month of March plant distribution included 2,500 onion plants, 18 coco-nut plants, 3 grafted mango, and 11 ornamental plants, 225 lb. yams, 2 lb. kidney beans, 150 lb. horse beans, 178 lb. onions. Planting and other cultural operations were carried out in the Botanic Garden. Mr. R. O. Williams, Superintendent of Agriculture, states that the cacao crop is practically over, and there is no likelihood of but small gatherings for some time. The present price of wet muscovado sugar is 4*d.* per lb. Grinding is in full swing, and the area planted in sugar-cane is being extended. Marie Galante seed-cotton is being sold at $18 per 100 lb. Cattle for butcher's meat still continues scarce: hogs are fetching high prices due to their scarcity. Sporadic efforts continue to be made in the interest of this industry. A pair of registered Duroc Jerseys have recently been imported from New York for breeding purposes. An active propaganda is in progress in connexion with the Food Crops Campaign: plants and seeds are being purchased for free distribution. The rainfall recorded at Richmond for the month was 2·51 inches.

ST. VINCENT. General routine work was performed in the Experiment Station and Botanic Garden during the month of March. Plant distribution comprised 1,000 onion plants, 40 coco-nut, 2 grafted mango, and 9 miscellaneous plants. Mr. Jackson states that fairly large areas of old cotton plants were destroyed during the month. The reaping of sugar-cane continues. There are indications that the area under cotton will be further increased during the coming season. Vegetables are plentiful, and fairly cheap. The cotton ginnery received for ginning 151,925 lb. of Sea Island seed-cotton, and purchased 58,697 lb. of clean Sea Island cotton, and 11,781 lb. of stained. Of Marie Galante cotton 45,035 lb were purchased, and 1,050 lb. received for ginning. At Clare Valley, Questelles, where the chief crop grown is cotton, the reaping is practically completed, but the returns obtained vary considerably, the highest being at the rate of 1,000 lb. of seed-cotton per acre, and the lowest 48 lb. per acre. From the same land, corn, cassava and pigeon peas were also obtained. Cotton stainers are reported as generally scarce at Bequia, although somewhat numerous on one estate. The rainfall registered for the month at the Experiment Station was 4·06 inches; at the Botanic Station, 5·74 inches. The rainfall for the year to end of February was incorrectly reported in the previous issue as 21·66 inches; the correct figures are 14·55 inches.

BRITISH VIRGIN ISLANDS. The Curator, Mr. C. A. Gomez, writes to say that from the ¾-acre plot of onions planted at the Experiment Station at Tortola in December and January, 2,573 lb. of onions were sold during the month of March for the sum of £45 7*s.* 1*d.*, and there is yet a fair amount to be reaped from the plot. This serves to demonstrate the value of this industry, if taken up on a large scale in the British Virgin Islands. During the month 1,050 cane plants were distributed. The price of seed-cotton has been raised to 1*s.* per lb. for first-grade Sea Island. The total crop handled at the Government ginnery to date aggregated 110 bales; while for the quarter ended March 31, 13,135 lb. of seed-cotton were shipped and sold privately. Preparation for planting is in progress in all islands of the Presidency, and the acreage under cotton this season will be doubled. The sugar crop continues to be reaped, and sugar is now obtainable in Tortola. At the Experiment Station 50 barrels were manufactured for the peasants. Beats of all crops in general are on the whole, less severe than usual; the cotton stainer, however, is still in evidence. The rainfall recorded for the month was 1·36 inches.

AGRICULTURE IN BARBADOS.

The weather during the past few weeks has been almost as dry as that for the corresponding four weeks of last year, and in Christ Church the total rainfall for March is less than in any year since 1912, last year excepted.

In addition to the absence of rain, the brisk breezes which have been perpetual have assisted in the drying process, and produced a marked change in the colour of both fields and pastures. There is now an earnest desire for a heavy rain to bring about a change, and to refresh the parched fields. Along the seaboards everyone says rain is sadly needed.

In spite, however, of the deficiency of rain during the past four weeks, the total rainfall for the year to date, both in Christ Church and on the hills, is 4 inches in excess of that at the same date last year.

The young cane crop generally is still holding out well, but in some fields some dry shoots and yellow blades have recently made their appearance. The earth, too, is beginning to crack. It is in weather such as this that proper tillage and liberal manuring tell. Nothing can take the place of good tillage and a well made up basket of farmyard manure in each hole.

The reaping season has been faultless. The factories, of course, where the machinery is going without hitch, are not dependent on the freaks of weather, but, even with them showery or calm weather has a delaying effect. With the windmill and the steam mill, where fuel is dried, it is otherwise; but this year with these processes there has been no hindrance of any kind. It has been found possible to carry out each day's programme to order. The result has been that, in spite of the delay in starting the crop, the close will, at the present rate of progress, arrive at as early a date as usual. It is well that reaping should be as rapid as possible, for the canes are drying and losing their tops.

There has been an extra good return from fields here and there, but the yield in general is not more than moderate. The price, however, more than compensates for the moderate yield.

A factory system was needed to enable us to make the best of our crop after it had left the fields. Progress is now being made in this direction, and soon only four months of the year will be occupied with sugar manufacture: that is, but few immature or overripe canes will be cut. There will also be no loss of sugar from the field to the mill, because all canes will be ground within twenty-four hours after they have been cut.

It has been impossible during the past four weeks either to prepare for or to plant ground provisions of any kind.

Everywhere the tillage for ground provisions should be thorough, and it is recommended that sheep manure be applied to the fields to be planted in potatoes. This experiment has been successfully tried on more than one estate. After three crops of canes have been reaped, the soil is too exhausted to yield a fair return of potatoes, unless it has been specially fertilized. (The Barbados *Agricultural Reporter*, April 17, 1920.)

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The noiselessness is obvious. A mop passed over it will remove all surface accumulations, but the chief advantage looked for, and one the importance of which it is difficult to overestimate in these days of motor traffic, is the non-skid quality which the new road is expected to exhibit in a marked degree. It is interesting to note in this connexion, that the first use of rubber as a road covering was motived by a desire to do away with noise. With this single aim in view, several London hotels some time ago adopted slabs of rubber, about 6 feet by 3 feet, and of 2-inch thickness in situations where the noise of incoming and outgoing traffic was a nuisance. Some trouble ensued owing to a shrinkage of the rubber which caused partitions between the edges of the slabs, and this experience suggested the use of blocks.

Former experiments have been full of teaching as to what to do and what to avoid. No doubt the present test will have been of great utility in this respect, even if it does not at once demonstrate that the right system has been adopted.

INSECT NOTES.

SOME INSECT PESTS OF THE CASTOR OIL PLANT.

A correspondent from Bahia, Brazil, Mr. George M. Chard, has recently favoured us with a communication on the subject of castor oil plant cultivation in that province, where he states that there are districts eminently suited to that industry. The vigorous growth of the plant, and the large amount of seed produced per plant, as recorded by Mr. Chard, seem to substantiate his opinion.

He states, however, that in Brazil the castor oil plant is absolutely free from attacks of pests and diseases. This is not the experience of cultivators in other parts of the world.

In Florida, for instance, as recorded in the *Quarterly Bulletin of the State Plant Board of Florida*, January 1920, not less than five insects are listed the larvae of which do considerable damage to castor oil plants. The most trouble some appears to be the semi-tropical army-worm (*Xylomyges eridania*), which during the Summer of 1918 made its appearance in destructive numbers in Central and Southern Florida.

The outbreak of the worms in July was very threatening, but means of control were promptly resorted to, and the pest was kept under.

The larvae attack all parts of the castor oil plant and of many other plants. The leaves apparently are preferred, the young fruit-spikes come next, and then the petioles of the leaves and the tips of the plant are last attacked. The older worms, which congregate in the day time near the base of the plant, very generally eat off the bark there. Nearly mature spikes are not usually severely injured.

Besides the castor oil plant, cotton is probably next in favour as a food-plant of these larvae. They attack the immature bolls even when plenty of foliage is available ; they eat the bark near the base of the plant where numbers of the full-grown larvae cluster ; and the flowers are also freely eaten.

Many other cultivated plants are attacked by this insect, among which may be mentioned sweet potato, velvet bean, egg plant, okro, pepper, water melon, avocado, peanuts, cowpeas and citrus. Non-cultivated plants of very many kinds are also eaten by the larvae, and it is probable that the infestation first spreads from these to the cultivated plants.

Four methods of control have been employed with satisfactory results: (1) picking the leaves on which egg-masses or broods of young caterpillars exist, (2) dusting with arsenicals, (3) spraying with arsenicals, (4) using poisoned bait.

1. *Picking leaves.*—When plants are thoroughly infested with the larger caterpillars, this practice would result in defoliating the plants to almost as serious an extent as would be the result of the attacks of the caterpillars themselves. The method which has produced excellent results, it is stated, is to collect the leaves before the young broods have scattered.

2. *Dusting with arsenicals.*—It was found that using a dusting machine was the most practical method of application. The dusting mixture generally employed consisted of 1 part of powdered lead arsenate to 4 parts of hydrated or air-slaked lime.

3. *Spraying with arsenicals.*—The results appeared to have been very satisfactory. Lead arsenate spray was found very effective.

4. *Poisoned bait.*—The bait used consisted of one-half otton-seed meal and one-half rice bran poisoned with 1lb. of Paris green to 24 lb of the mixture, and sweetened with syrup. This was broadcasted on the ground, and gave good results in the destruction of the older larvae which crawl on the ground from plant to plant.

Besides this insect, it has been found in Florida that the common corn ear worm (*Chloridea obsoleta*) had a taste for castor oil beans, and that the larvae of *Laphygma frugiperda* also did some small damage to the plants.

THE YAM WEEVIL.

An article in the *Quarterly Bulletin of the State Plant Board of Florida*, January 1920, notices the interception by Plant Quarantine Inspectors of dangerous material containing an insect pest not at present known in the United States.

A passenger from Kingston, Jamaica, viâ Havana, Cuba, landed at Key West, Florida, bringing a yam (*Dioscorea* sp.) from Jamaica. On inspection this yam was found to be infested with some small, yellowish-white larvae. These were referred to the Entomological Department of the State Plant Board, and on September 19, 1919, were placed in a breeding jar. On October 4 one adult had emerged. On November 7 three live and three dead adults were obtained, together with one pupa. They were identified as the Yam Weevil (*Paleopus dioscoreae*).

Considering the number of weevils reared from the small portion of yam sent in, it would seem that this weevil is one which might occasion much damage and loss to yams, and possibly to sweet potatoes, especially in that part of Florida where the conditions are of a more or less tropical or sub-far tropical nature. In Jamaica this weevil is said to live on the yam (*Dioscorea* spp). This vegetable is grown as far north as New York State. The serious question presents itself whether this insect, like other undesired and introduced insects, might not adapt itself to other than its native tropical climatic conditions.

PLOT EXPERIMENTS WITH CACAO.

In the Report on the Agricultural Department, Dominica, for 1918-19, there is a very interesting section treating of the difficulties of obtaining accurate results in experimental plots of orchard cultivations in the West Indies. The first portion of this section deals with plot experiments on cacao, most of which is reproduced below.

A number of manurial plots in cacao cultivation have been carried on at the Dominica Botanic Gardens for the past nineteen years. These have proved highly interesting, and though by necessity the area under these trials is limited, the results, in spite of defects incidental to this class of experiment, have afforded to planters and scientists broad general indications of the main requirements of cacao cultivation in this island.

In discussing the subject of plot experiments, it may be stated at the outset, that accurate results, such as are supposed to be attainable in sugar-cane cultivation, and with other annual crops, such as cotton, etc., are under present conditions unattainable in the case of orchard cultivations.

Very different is the work of recording the yields in orchard cultivation. In these cases the crops are coming in practically all the year round, and unless the persons carrying them on are keenly interested, the routine is apt to become monotonous, which may lead to indifference, and the making of mistakes on the part of those entrusted with the work of recording the yields.

In the early years of the Imperial Department of Agriculture, several attempts were made to obtain information by co-operating with planters in carrying on manurial experiments on estates, but in every instance these failed, owing to the difficulty of keeping records, which, in cacao cultivation amounts to twleve or fourteen pickings a year, and in limes, to sixty or more collections during the same period. The close supervision required over labour engaged on the plots, and the measuring and recording of crops is such that no manager of an estate can be expected to undertake them in addition to his usual manifold duties.

On the starting of the manurial plots in Dominica in 1910, it was pointed out that fields of cacao were usually made up of various strains, some of which were good, and others indifferent bearers. This was done with the object of advising the planters always to select seed for sowing from the prolific strains. The full significance of this variation in yield of individual trees, and its effect on manurial experiments were not comprehended for some years later, indeed, not until the remarkable set of experiments with cacao was undertaken by the Agricultural Department of Trinidad, when it was found that what is termed the natural yield of individual trees could very seriously disturb the manurial experiments, that is, the accidental grouping of high yielding trees within the area of a plot or plots would give misleading results as to the particular value of the manure or manures used, and vice versa in the case of low yielding trees.

In the attempt to obtain even approximate results, it is necessary to repeat the series of experiments several times, also to carry them on for a considerable number of years. Short term manurial plots in orchard cultivation may be very misleading.

As far as crop returns are concerned, short term plots, to which mineral nitrogenous manures have been applied, will give the highest results, but a few years of this treatment will leave the soil and the trees in a poor and unbalanced condition. In this connexion it should be remembered that it is as easy for a manager of a tropical estate, by following an unsound system of manuring, practically to ruin a soil and to make things impossible for his successor, as in bygone days the English farmer, for the same reason, could prevent his successor in the tenancy from making a living out of the land.

This question of natural yield of cacao trees is one that requires very careful examination. As is well known, the climate of some islands is only a second class one for the higher types of cacao, such as the Criollo variety. It is only the Calabacillo and hardy strains of the Forastero variety that succeed. The Criollo variety, and the best strains of the Forastero are more prone to disease than the former. Generally speaking, in cases of attacks by canker (*Phytophthora faberi*), many trees are usually abnormal bearers for the longer or shorter term of their diseased existence. Unless very carefully examined, it might follow that the natural yield in a number of cases might be affected by the abnormal bearing of a number of diseased and dying trees. It is possible, unless great care is exercised, that the so-called 'natural yield' of cacao trees might lead to greater errors in manurial experiments than the general acceptance for plot purposes that all trees are average bearers. It will be seen that the prevalence of canker is likely to prove a disturbing element in all cacao experiments, both in regard to the determination of the natural yield, and again in the manurial experiments.

The presence of canker would also operate in another direction. In some circumstances considerable numbers of full grown, or nearly full-grown pods are attacked and destroyed by it. In Dominica, the proportion of pods so destroyed is always larger, in fact it may be said to be chiefly confined to varieties which yield high-grade cacao. The accidental grouping of such kinds in a field devoted to plot experiments would introduce another disturbing element. It may of course be argued that, if canker of the trees produce abnormal bearing, especially in the Criollo variety, and if the same canker also destroy a large number of pods of the same kind, one balances the other. Even if this could be proved to be near the truth, it would be difficult to accept such a solution in any well regulated experiments. And there is another disease at work known as brown rot, which takes a toll of cacao pods, the attacks of which may be very unequally distributed in a plantation.

Another disturbing element in cacao experiments is the presence of rats. In spite of efforts to keep them down, they usually succeed in exacting a considerable toll. And again, the attacks are often unequal, that is, the rodents may exhibit a preference for individual trees, or for groups of trees in certain parts of the field. To some extent the losses under this head could be followed up by collecting the attacked pods, and calculating the amount of beans lost. But it is doubtful if this is done in any of the experiments of the present day. The yields given are those of cacao actually collected and sold, and it would probably be unwise to introduce any form of calculating crops, in addition to the actual crop gathered.

Much might be done to control canker in plantations by spraying. Information on this matter may be found on referring to the spraying experiments in Trinidad, which show the heavy losses caused by canker, and their possible effect on plots Also the variation in yield of seedling trees might be overcome to some extent by making experiments with budded or grafted cacao, that is, with a single variety instead of many varieties as at present. It is understood that this is being done on a considerable scale in Trinidad.

The report of a deputation which the British Cotton Growing Association sent to Mesopotamia to investigate the cotton-growing possibilities of the country, was issued at the end of February. It states that when the country is opened out by canals, the possibilities are excellent. At experimental farms near Bagdad splendid results were obtained, even better than those in the delta of the Nile. (*The Times* Trade Supplement, February 28, 1920.)

GLEANINGS.

In view of the possibilities in the export of dried bananas, it is interesting to note the extension of the banana cultivation in Queensland. In 1898 there were 5,246 acres under bananas, while in 1918 there were 7,817 acres, from which the returns given were 1,267,641 bunches. (The *Colonizer*, March 1920.)

The *Journal of the Royal Society of Arts*, January 27, 1920, draws attention to a recent report on the Waipoa kauri forest in New Zealand. It is maintained in that report, that individual kauri trees in the Waipoa forest have reached a greater size than any other tree known, exceeding even the Californian sequoias. Two examples are mentioned each of which contained 295,788 feet of sawable timber, about double the amount of the largest of the Californian big trees known.

Palm nuts form the chief article of export from the Belgian Congo. The production in 1918 was estimated at 40,000 tons as against 80,000 tons in 1914. In 1918 there were also produced 7,000 tons of palm oil as compared with 2,500 tons in 1914. The production of oil is however limited by the facilities available for transport. A prize of 25,000 francs is to be offered for the invention of a tractor driven by palm oil. (*The Board of Trade Journal*, March 11, 1920.)

The *Perfumery and Essential Oil Record*, March 23, 1920, refers to the cultivation of roses in Cyprus for the manufacture of otto of roses, which was renewed in 1918. The oil sent in 1917 to the Imperial Institute was found to be similar to the Bulgarian article, and fetched 70*s*. per oz. This for a first trial was regarded as quite satisfactory. The price realized has induced many villagers to plant rose bushes, and a considerable extension of the industry, especially in the hilly country and along the boundaries of vineyards may be looked for.

The *Rhodesia Agricultural Journal*, February 1920, emphasizes the advisability of accepting the making of ensilage as an essential part of farm practice in that country. The recent drought in the Union of South Africa should be sufficient to bring home to stock owners the vital necessity of taking measures to counteract such occurrences. The making of ensilage in Rhodesia is so simple a matter, and its value so great, that neglect of such a precaution is surprising. Even in years of short rainfall it is possible to secure good crops of summer fodder which might be conserved in the form of ensilage.

The etherised alchol which the Maui Agricultural Company is making in Hawaii from so-called waste molasses has proved an unqualified success, it is stated. The fuel gives more mileage than gasoline, and at considerably less cost. So great has been the use found for the product, and so large the demand, that the company is planning to treble the capacity of the distillery. (*Facts About Sugar*, March 20, 1920.)

Farmers and fruit growers in the United States of America and in Canada have realized the importance of the honey-bee, and the great part it plays in the pollination of flowers. Bee-men have been offered as much as $5·00 per colony just to keep their bees on certain estates during the fruit season. The *Proceedings of the Agricultural Society of Trinidad and Tobago*, February 1920, states that in Trinidad, the Usine Ste. Madeleine Company have realized also this importance, and are keeping bees on their coco-nut estate at Plein Palais

The *India Rubber Journal*, March 20, 1920, states that it is reported that an invention has been made in the United States for the production of a rubber substitute from hitherto almost waste material. This substance is said to possess many of the desirable qualities of rubber, for which it may be employed as a substitute in many cases. The materials forming the new substance consist of a base of fish oil, fish, or fish scrap relatively rich in fish oil, and sulphur, through the composition of which, under suitable treatment, the materials are converted into a commercial substance of value.

Cotton growing in Uganda is entirely a native industry. It has been built up in a comparatively few years, and is much the greatest success which has rewarded the British cotton-growing movement in Africa. The crop this year, it is hoped, will yield 50,000 bales. It is grown in plots of from ½ acre to 2 acres by thousands of small cultivators throughout the country, and is harvested and carried to the ginneries by the natives themselves. The quality of the cotton is a little below Egyptian, but higher than that of any other African or Indian staple. Its present value in Manchester is about 4*s*. per lb. (*The Field*, March 27, 1920.)

In the Report for the year 1918-19 on Jamaica, No. 1024 of *Colonial Reports*,—Annual, it is stated that 1,175 tons of honey were exported, to the value of £154,700. Unfortunately during the year, on account of the transhipment of infected honey from Cuba in the port of Kingston, the disease known as 'American Foul Brood' gained an entrance into the colony through the access of local bees to the Cuban honey in the port. As the disease was spreading rapidly, it was decided to destroy all hives of bees within an area of approximately 3 miles from the Parish Church, Kingston. This was done in January 1919, and reports received indicate the complete success of the operation.

There are no true lilies in the Southern Hemisphere, but Nature made an excellent substitute in South America by providing the Hippeastrums which are quite as beautiful as lilies, though only a few species have been discovered. Gardeners have crossed several of these, so that now there are quite a number of varieties, ranging in colour from deep crimson to snowy white. *The Field*, February 21, 1920, suggests that some enterprising gardener in a tropical country should take up cultivation of the Hippeastrums on the same lines as the Japanese follow with lilies. If the bulbs could be produced yearly in great quantities, a good market would probably be ensured in Great Britain and elsewhere.

A STUDY IN POLLINATION.

The Imperial Economic Botanists of India, Mr. and Mrs. Howard, and one of their Assistants, Abdur Rahman Khan, have published in the *Memoirs of the Department of Agriculture* in India (Botanical Series), December 1919, a paper giving results of investigations made by them at Pusa on the methods of pollination, and the occurrence of cross-fertilization in some crops of India.

As the authors point out, the bearing of pollination studies on such subjects as the methods of improvement of crops, the introduction of exotics, the maintenance of type, and the distribution of pure seed to cultivators, is of considerable importance from the point of view of the application or otherwise of the methods of pure line selection.

One of the plants experimented with was the pigeon pea (*Cajanus indicus*), well known in the West Indies. This is a crop widely grown and of great value in India, the amount of the yield of which is of far greater importance than the quality. The problem therefore before the breeder is to secure the heaviest crop possible. In carrying this out, the facts dealing with pollination and fertilization show that other factors besides potential yielding power are involved. Fertilization depends on atmospheric conditions, and practically no setting takes place during damp, dull weather, although self-pollinated flowers may be produced in profusion. This adverse factor can be avoided by increasing the range of the flowering period, which result can be achieved most easily by the growth of a mixture of individuals differing considerably in time of flowering. This, however, involves the rejection of the method of pure line selection, and the adoption in its place of mass selection, in which crossing within certain limits is permitted.

It would seem that two varieties of pigeon pea are cultivated in India: (1) early maturing with a dwarf habit, and (2) late maturing with a tall habit. The crop is characterized by the great length of its flowering period and by the enormous amount of flowers it produces. All are self-pollinated before the flowers open, but the great majority fall without setting any seed. Setting depends on the humidity of the air. Dry, bright days favour fertilization, when setting takes place freely under nets which exclude insect visitors, thereby proving that self-fertilization readily takes place under such atmospheric conditions. The fact that the flowers are constantly visited by bees, suggests that cross-fertilization is also possible through the agency of these insects.

As is well known, there are considerable differences in the colours of the flowers of the pigeon pea, and in the colours of the seed. The authors state that there appears to be no obvious connexion between the colour of the seed and the colour of the flowers. Plants having similar flowers differ as regard the colour of the seeds, while similar seeds produce a wide range of colour in the flowers.

As was stated above, the quantity of yield is of far greater importance in the pigeon pea crop than the quality. Seeing that fertilization is dependent on the weather, to ensure the crop therefore a fairly wide range of forms as regards time of flowering, is almost certain to give better results than a pure culture. As the results of experiments made on this point at Pusa, the authors consider that although the results do not prove that pure line selection in this crop will never under any circumstances lead to improvement, they indicate, however, that the method will be attended with very considerable difficulties. The best results, therefore, will probably be attained through continuous mass selection by the elimination of unthrifty plants.

MANURING CANE FIELDS IN LOUISIANA.

The following paragraphs are taken from the report of the Committee on Agricultural Progress to the Louisiana Sugar Planter's Association, which was printed in the *Louisiana Planter*, March 20, 1920 :—

The application of fertilizers in 1919 was greatly delayed, and with few exceptions fertilizers were not applied until the early part of June. The exorbitant prices and scarcity of commercial fertilizers prevented planters from making their usual applications. Tankage, bat guano, and cotton-seed meal were the most popular fertilizers used.

At first these products were about the cheapest fertilizers on the market, but the growing demand has increased the price.

The reports obtained from plantations using tankage and dat guano show that very little good was derived by the cane crop from these fertilizers last year. Excellent results are reported from mixtures of cotton-seed meal and acid phosphate. A mixture of 200lb each per acre was used on stubble cane.

The application of filter-press cake was conducted throughout the sugar district. Planters are convinced of the value of this material as a fertilizer, and are taking time to apply it to their lands. There are many instances where lands that produced 20 tons per acre, produced 30 and 35 tons per acre after a liberal application of filter-press cake. It also has the same effect on corn, increasing the number of bushels per acre. The filter-press cake increases the fertility of the land for at least two or three years.

The use of stable manure is increasing every year, and efforts are being made to construct proper manure sheds and pits to collect the manure. The small planters are ahead of large planters in the use of stable manure. As a rule the former take great pains to save all of the manure, and will oftentimes go to the trouble of buying manure from stables in neighbouring towns. This manure is carefully applied to crops of cane and corn. Some of the large planters have purchased manure spreaders, and are applying more manure than in former years.

A field test on sugar-cane using stable manure has been conducted. Two plots, side by side, were selected for the purpose, with uniform land and stand, and both receiving the same preparation and cultivation. On one plot manure was applied at the rate of 2 tons per acre, and the other plot was left without manure or fertilizer. The plot that received the manure gave an increase of 4·2 tons of sugar-cane per acre.

The general practice in the sugar district in the application of fertilizers is to fertilize only the plant cane. As a rule the land of the plant cane crop has been in peas, and has either received all of the crop, or one-third of the crop, as green manure. This gives a sufficient amount of nitrogen to take care of a good crop of cane. However, while the peas enrich the soil in nitrogen, no phosphoric acid is added, and, as phosphorus is one of the essential plant food elements, cane crops on such lands, while they yield heavy tonnages generally, produce juices that are a little low in sucrose. Applications of acid phosphate, at the rate of 200 lb per acre to plant cane, have improved the sucrose yield of plant cane crops.

PLANT DISEASES.

THE WATERY OR MONILIA DISEASE OF CACAO PODS.

In view of a movement originating with British manufacturers of cocoa for the cultivation of Ecuadorian varieties of cacao in British colonies, it is desirable to give an account of a disease which causes much damage to the cacao crop in Ecuador, so as to indicate the necessity of adequate precautions being taken against its introduction with planting material.

The description is derived from a handbook on the diseases of cacao in Ecuador, written by Mr. J. B. Rorer in 1918, as a result of studies arranged for by the Agricultural Association of that country, to which the author has now been appointed Mycologist.

This disease, Mr. Rorer considers, ought to be designated the 'watery' or 'Monilia' disease, although it is known under other names, such as 'Quevado' disease, 'Frost Bite' disease, and sometimes, 'Spot' disease. These names, however, are apt to cause confusion between the disease here described and other diseases affecting cacao trees.

Dr. Ralph E. Smith, Professor of Plant Pathology in the University of California to whom specimens were submitted, considers that the disease is caused by a fungus belonging to the genus Monilia, other species of which cause rotting of various kinds of fruit in the United States and other countries.

The first manifestations or positive symptoms of the 'Watery' disease manifest themselves on young pods when about a quarter of their full size, and from 8 to 10 centimetres in length. On such pods the external evidence of the disease is shown sometimes in the shape of a very small protuberance, or sometimes by the presence of a special discoloration, which will be described below. When the pods which present such exterior marks are cut, it is observed that in various parts of the interior there are certain bands, or rather dark-brown veins, present.

In more developed pods there may only appear slight signs of disease. In other cases the pods show on the surface one or more dark spots, or, in their absence, they are more or less completely covered with a whitish powder, which corresponds with the growth of the fungus.

In the first case the pods manifest a slight abnormality in form, or appear somewhat discoloured, presenting areas of a bluish or sometimes yellowish colour, as if premature maturity was being attained. This form of the disease is generally known under the name of 'Quevado' disease, although it is not found restricted to the locality from which the name is derived, but appears in other places where the climatic conditions are similar to those of Quevado. The diseased pods are always noticeably heavier than healthy pods of equal size, and are difficult to cut, because the interior coat of the husk has become hardened.

The slight abnormality in form of the pod, and the presence of dark-brown veins in the interior tissues resemble the symptoms of the disease known as 'Witch Broom', common in Dutch Guiana, but in other respects the two diseases are entirely distinct.

When diseased pods are cut open, it is observed that the interior of the husk, the central tissues, the pulp, and the seeds have become enveloped in watery matter. Occasionally from one pod of this class may be drawn off liquid sufficient to fill the fourth part of a tumbler. All the interior matter of the diseased pod is found surrounded by a dark-brown coating, which carpets also the interior partitions of the husk. The husk itself, when cut, exhibits black or dark-brown strands or spots in its tissues, and sometimes small watery cavities or areas surrounded by a dark-brown boundary which is quite conspicious and definite. In addition, there may be areas which present a striped or mottled appearance. The seeds of these pods have no value. When the pods are cut and allowed to lie on the ground they are soon covered with a shaggy coat, white at first and yellow afterwards, according to the development of the fungus.

In other cases the diseased pods display on their surface blackish gray spots of different sizes, from ½ to 3 or 4 centimetres in diameter; many spots of this kind may appear, or only one. The interior of these pods has the watery appearance already described, but almost always not so much developed. This form of the watery disease is known as the 'Spot' disease, but it ought not to be confused with the disease caused by the fungus Sphaeronema to which the name of 'Black Spot' has been given. In this spot form, the same dark bands are found in the central tissues, and the pulp of the pods, and the interior of the husk show the striped or mottled appearance already mentioned. After some time the fructifications of the same fungus found in the watery form of the disease, appear on the surface of the spots, and if the pods are placed for some days on the ground, they become covered with the same shaggy, whitish coat.

The third form of the watery disease is generally observed on the 'Venezuela' cacao, although not restricted to this variety. In this form there can be no doubt that the pods are diseased, because they appear from the earliest stage to be partly or totally covered with a dense and shaggy mass of fungus, 1 to 2 millimetres thick, white on the margin, and slightly yellow or ash-coloured in the centre. When this is touched, a considerable portion of the coat of spores sticks to the fingers. Around the whitish masses of the fungus, the superficial tissues of the pod exhibit a dark-brown colour, extending for as much as 5 centimetres; and in some cases the whole pod acquires this colour before the fructifications of the fungus appear on the surface. When the pods of the 'National' cacao exhibit this form of the disease—which is somewhat rarely—they have up to a certain period the same watery appearance described, but in the 'Venezuela' variety this symptom is less marked.

Observations on diseased pods have clearly indicated that the pods can only be infected at a certain period of their growth, possibly when they are very young; it appears that after the pods have reached a certain stage, they become immune to infection.

It is almost certain that the spores of the fungus germinate on the surface of the pods, and that their filaments penetrate into the interior of the tissues either through the epidermis, or through the stomata. It is doubtful whether this fungus needs a previous wound on the pods in order to develop there, since very many bacteria and parasitic fungi which cause diseases of plants, can obtain ingress by perforating the healthy epidermis. There is no doubt, however, that the fungus more readily penetrates the plant through wounds.

There does not seem to be any doubt that bacteria and fungi are carried from one place to another on the legs, wings, or bodies of insects, and that they infect new

plants through the wounds produced in sucking or biting their food. It does not seem, however, that such insect attacks are necessary for the spread of this particular disease.

The disease is doubtless indigenous to Ecuador, since it is found on two wild species of cacao *Theobroma bicolor*, and *Theobroma balaoensis*. It is especially present in localities where there is a heavy rainfall. In drier districts the disease causes much less damage.

ANTIGUA: REPORT ON THE AGRICULTURAL DEPARTMENT, 1918-19

The report under review is a particularly interesting one. Most of the section dealing with the sugar-cane industry has been already reproduced in the previous issue of the *Agricultural News*. In addition to this, however, there are many other points which show that the Agricultural Department in Antigu is carrying on effective activity on many lines.

The Botanic Station continues to produce and distribute much planting material, among which may be noted the increased demand for sisal plants. A number of Eucalyptus seedlings also have been distributed, and it is hoped that in a few years these trees may yield a lasting wood for making railway sleepers for use on the tramways of the central factories. It has been found that the wood of *Eucalyptus rostrata* lasts for many years, even when buried in the soil.

The plot experiments have given some interesting results. Taking root crops first, it appears that twenty-four varieties of seedling sweet potatoes, which were raised during the year 1915 16, were again planted out, with the object of testing them against the standard variety 'Hen and Chicken.' Seventeen of the new varieties gave heavier yields than the standard against which they were tested. The variety A. 12 has proved a very heavy yielder, the average yield per acre for three years having been 13,760 lb. This is recommended as worthy of trial on estates. It is remarked, however, that little is known at present about the cooking qualities of some of these varieties, several others of which appear well worthy of experiment in regard to their yield. An interesting series of experiments was also conducted with the endeavour to ascertain how sweet potatoes might best be kept after reaping. Several varieties of potatoes were packed in barrels filled with sand, and it was demonstrated that, if perfectly dry sand is used for this purpose, certain varieties may be kept in good condition for as long as six month.

The plot experiments with yams have been continued for seventeen years, and the variety known as 'Light Red,' continues to hold the first place in yield, having given calculated yields per acre of 23,373 lb. for the crop under report.

Interesting results as to the value of various plants for fodder purposes are recorded in the report under review. It is suggested that the following cereals are worth trying: pearl millet (*Pennisetnm spicatum*), Sudan grass (*Andropogon Sorghum*, var.), and Kaffir corn, another variety of *Andropogon Sorghum*. A legume, which seems to have given good results for the above mentioned purpose, is 'Beggar weed,' (*Desmodium tortuosum*), which has the reputation of growing best on light sandy soil. This plant is relished by stock, and is highly nutritious. It is also of value as a green dressing, and, when sown broad-cast, a dense growth is rapidly produced which keeps down weeds.

With regard to the cotton industry, it appears that, although there has been a certain increase in acreage under this crop in Antigua and Barbuda, the returns per acre have been noticeably poor. This is accounted for by the fact that during the year under report the crop suffered severe attacks of insect pests, especially the cotton worm. (*Alabama argillacea*), and the cotton stainer (*Dysdercus andreae*). It is to be hoped that the plant legislation now in force, both as to a close season for cotton, and as to the destruction of hosts plants of the cotton stainer, will lead to a better control of these pests.

With regard to minor industries, it seems that little or no progress is being made in the planting either of limes or coco-nuts. It is true, that there are not many localities in Antigua suitable for these. But still, if more attention were paid to the matter, it might be advisable to extend these cultivations, instead of depending almost entirely on sugar-cane or cotton.

There has been a decease in the area planted under onions during the year reported on. The cause of this is probably that, owing to war conditions, the onion seed from Teneriffe arrived too late in the season for profitable planting. In Antigua, onions are chiefly grown on the banks of cane fields, and if transplanted there when the cane plants are much advanced, they do not mature. This, however, has led to the demonstration of the fact that onion seed can be stored in air-tight vessels over quicklime, and give excellent germination after a period of at least nine months.

A considerable amount of corn was grown in the island during the year under report. It is hoped that the kiln-drying plant attached to the Government Granary will be a stimulating influence to the cultivation of this crop.

A section of the report deals with experiments carried-out by the Department in reafforestation. Some fifteen years ago two plots in wind-swept positions, and of rather poor fertility, were planted with various trees, chiefly of species indigenous to the West Indies. Now the trees of most of the varieties are healthy, and in a thriving condition, which shows what might be done in Antigua if a policy of tree planting were inaugurated. In most parts of the island, Antigua is particularly deficient in woods, there being hundreds of acres which produce only the coarsest of grasses and the most useless of scrub plants. Many of these waste places, it is evident, might be planted with trees of an economic value. Some difficulty would doubtless be experienced in establishing such forest areas, for two reasons. First, most of this type of land is used for turning cattle, sheep, goats, etc., out to pasture; therefore, unless the trees were fenced in, and this practice stopped, the young trees would be destroyed by the stock. Secondly, the practice of burning these waste pasture lands during the dry season is only too common. This practice also would have to be discontinued, if afforestation is to be a success.

MARKET REPORTS.

London.—The West India Committee Circular April 1.

Balata—Venezuelan Block, no quotations ; West Indian Sheet ; spot, 4*s.* 8*d.*, forward, 4*s.* 4½*d.*
Beeswax—No quotations.
Cacao—Trinidad, 138*s.* to 148*s.* Grenada, St. Lucia, and Dominica, 121*s.* to 139*s.*
Copra—£64.
Honey—80*s.* to 100*s.* per cwt.
Lime Juice—Raw, 3*s.* 6*d.* ; Concentrated, no quotations.
Pimento—6*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T. S. Garraway & Co., April 28.

Arrowroot—$9·00 per 100 lb. duty paid.
Cacao—No recent sales.
Coco-nuts—$52·00 husked nuts.
Hay—Market bare.
Onions—Lottings at $17·79.
Peas, Split—No quotations; Canada, Market bare.
Potatoes—$8·00.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, March 23.

Bay Oil—28*s.* to 29*s.*
Lime Oil—6*s.* 6*d.* to 7*s.* for West Indian distilled, and 16*s.* to 17*s.* for hand-pressed.
Orange Oil—West Indian, 35*s.*

Trinidad.—Messrs. Gordon, Grant & Co., April 7.

Cacao—Venezuelan, $28·50 ; Trinidad, $25·50 to $26·00.
Coco-nut Oil—$2·40 per gallon.
Coffee—Venezuelan, 25c. per lb.
Copra—11½c. per lb.
Dhal—No quotations
Onions—$15·00 per 100 lb. Light stocks.
Peas, Split—$10·00 per bag.
Potatoes—English, $8·00 per 100 lb.
Rice—Yellow, $12·50 to $13·00. White, $14·00 per bag.
Sugar—No sales made.

New York.—Messrs. Huth, Gillespie & Co., Inc. April 9.

Cacao—Caracas, 22c. to 22½c.; Grenada, 19¼c. to 19¾c. ; Trinidad, 20½c. to 21c. ; Jamaica, 18c. to 19c.
Coco-nuts—Jamaica selects, $57·00 per M; Trinidad $56·00 per M; culls, Jamaica, $34·00 ; Trinidad $34·00 per M.
Coffee—Jamaica, 18c. to 24c. per lb.
Ginger—28c. to 35c. per lb.
Goat Skins—Jamaica $1·50; Antigua $1·50 ; Barbados No quotations; St. Thomas and St. Kitts $1·40
Grape Fruit—Jamaica, $2·25 to $3·75.
Limes—$7·00 to $8·00
Mace—37c. to 39c.
Nutmegs—26½c.
Oranges—$6·00 to $7·00.
Pimento—8½c. per lb.
Sugar—Centrifugals, 96°, 16¼c. c. & f. ; Muscovados, 89°, 14¾c.; Molasses, 89°, 14c.

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AGENTS FOR PUBLICATIONS OF THE IMPERIAL DEPARTMENT.

London: Messrs. Dulau & Co., Ltd., 34-36, Margaret Street, Cavendish Square, W.
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Barbados : Advocate Co., Ltd., Broad Street, Bridgetown.
Jamaica : The Educational Supply Company, 16, King Street, Kingston.
British Guiana : The Argosy Co., Ltd., Georgetown.
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St. Kitts: The Bible and Book Supply Agency, Basseterre.
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 801, Yonge Street, Toronto.

AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

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Counsels to Cacao Planters.

WEST Indian planters in general, and cacao planters in particular, should be gratified at the interest which is taken in London and elsewhere in the agricultural position of these islands—an interest which results from time to time in carefully tendered advice on matters connected with the improvement of products and the increase of output.

Some time ago cacao planters were advised in a London paper, though admittedly with some diffidence, to improve the quality of their chief product by planting high-class strains of cacao

To the general public such recommendation would appear to be normal and sound, but among experienced cacao planters, and especially among those who have spent several years and expended some capital in attempts to grow such delicate varieties as Criollo cacao in these islands, there is a feeling that such views are expressed by persons who have insufficient knowledge of cacao planting here, or of local conditions.

Such an expression of opinion as the above is the more regrettable when it is remembered that the cacao industry of several of these islands has been brought to its present highly successful position by the sound plan of growing a grade of cacao eminently suitable to local conditions. To those who are best acquainted with this cultivation, the suggestion to grow in these small islands the variety yielding the highest class of produce appears impossible of accomplishment under present conditions of growing cacao, for reasons which practical experience has demonstrated. It is possible that, as time goes on, improvements in the cultivation and care of cacao may permit of the Criollo variety being grown in particularly favourable localities in the small islands, but until the effect of such improvements can be demonstrated in practice, the planter if he is wise, will continue, even on his best lands, to grow the hardier kinds which he knows are suited to the climatic conditions.

The many friends of the planter, as far as the giving of outside advice is concerned, always insist that it is wisest to grow only the very best. As far as cacao production is concerned, such advice is in

reality unwise. The wise policy is to grow the variety which is best suited to local conditions, and to leave nothing undone in the work of preparing produce for market. By working on such lines West Indian cacao planters have accomplished much, and made a reputation for their produce.

Another piece of advice has lately been offered to cacao planters with regard to the flowering of cacao trees. It is well known that these trees produce flowers in abundance, and it is calculated that less than 1 per cent. of the flowers produce pods. In order to remedy this state of things, the use of a camel-hair brush has been advised, which it is suggested, if lightly passed over the flowers, would effect pollination, and increase thereby the yield of a plantation. In support of the practicability of this statement, it is pointed out that vanilla flowers are pollinated by hand—an example which might be followed with profit in other crops.

It is possible that very few planters have critically examined the flowers of cacao; those who have will see at once that pollination is not likely to be effected by the application of a camel-hair brush, however dexterously it may be passed over the flower. In explanation of this statement it may be remarked that the anthers of the cacao flower are enclosed in a hood formed by a portion of each petal, and so would remain untouched by the brush. Furthermore, the delicate pistil and stigma would run great risk of being injured by the operation of brushing; this risk would probably be a certainty, when it is considered how carelessly the work, if attempted, would be likely to be carried out. A more plausible suggestion for effecting pollination is that of using a very fine spray or mist of water, but there does not at present seem to be any experimental evidence that either method is practicable. Under present conditions, any such attempt would lead to an expenditure of money without any probability of an increased return in crop.

The comparison of what is done in case of the vanilla flower is, with reference to the cacao flower, somewhat unfortunate. The vanilla vine has a large flower, the structure of which allows it to be taken between the thumb and forefinger, when, with the aid of a thin splinter of bamboo, and by a single deft movement of the right hand, combined with a slight pressure of the thumb and forefinger of the left hand, pollination is effected. This process cannot be compared with the requirements necessary to effect pollination in the case of the minute flower and still smaller essential organs of the flower of the cacao tree.

It is interesting to note that, while the large production of flowers and the small production of pods on cacao trees is mentioned as a subject of regret, no notice is taken of the surplus flowers in the case of vanilla. Although cacao and vanilla are plants widely dissimilar, flowers are in each case borne abundantly. The vanilla planter, however, wisely sees to it that a large proportion of the flowers are not fertilized, or, so to speak, they are allowed to go to waste. Of each cluster of vanilla flowers, which may be from twenty to thirty in number, not more than six or eight are pollinated by good cultivators, and the number of clusters allowed on each vine is also limited. If all the flowers produced were pollinated, the grower knows that his vine would speedily fall into a weak condition, become a prey to disease, and bring loss on himself. In a case like this, in which pollination of every flower could be easily effected, it is found by experience to be inadvisable to do so; man, in this instance, doing exactly what nature does in the case of the cacao tree.

The natural agency which effects the pollination of cacao flowers is still not known with certainty, but it is distinctly possible that a species of thrips is concerned in it, as these insects are to be found in every flower, and pollen grains have been detected on their bodies. The often expressed regret that less than 1 per cent. of flowers yield ripe pods may be correct, but it is not a full statement of the position; as every cacao planter knows that a great number of pods fall off and dry up in the early stages. Therefore it may safely be assumed that the agencies for effecting pollination are present in a plantation in a sufficient degree to ensure good crops under good conditions of husbandry.

During recent years a good deal has been heard of the selection of high yielding varieties of cacao, and their propagation by budding and grafting; of carrying on manurial experiments; of the need of good cultural measures in plantations; and of the control of fungus diseases in fields by spraying. In every case in which measures such as these are adopted, an increase of return results. It is by working on these proved lines that crops will be increased, rather than by expending money on such futilities as trying to pollinate the flowers with a camel-hair brush—the only effect of which would be to injure or destroy the pistil and stigma; or by the use of a water spray which might fail in its object, and which would very possibly interfere to the detriment of the natural agencies—whether thrips or other—which at present carry on this work.

Again, it does not follow that if cacao flowers were pollinated artificially, at considerable expense to the planter, an increase of pods would result. The

main factor in crop production is the vigour and capability of the tree. It is probable that the cacao tree under present cultural conditions is yielding as well as can be expected, and that larger returns can only be obtained through the improvement by planters of their cultural methods in general, on the lines indicated in the preceding paragraph.

It is an established fact that excessive flowering of cacao trees is often caused by disease, and it is possible that trees weakened because of an insufficiency of plant food, or owing to bad soil conditions, or through undue exposure, likewise show this tendency. There is a strong probability that trees well grown and carefully manured, while they produce enough flowers to ensure large crops, do not produce them to any great excess. On this point it is desirable that careful observation should be made by persons carrying on experimental work.

In this connexion a parallel may be adduced as to the behaviour of the lime tree. During a pronounced dry season, lime trees growing on slopes near the coasts, in poor thin soil, shed their leaves and become almost white with flowers, practically all of which are pollinated by natural agencies. The crop which follows, however, is poor, owing to the weak condition of the trees. Vigorous lime trees fully manured do not exhibit this conspicuous show of flowers, and yet it is these which bear the large crops. This goes to prove that the vigour of the trees is the main factor in crop production.

It was claimed some time ago by an investigator in Java that cacao flowers are pollinated by the wind, and are therefore quite independent of all insect agencies. The picture which is drawn to support this view, namely that of the minute single flowers being swayed to and fro by the wind, is not a very convincing one, especially when it is remembered that most of the flowers are produced in clusters, in which form they assume a rigidity which does not permit of much movement. Should this supposition prove to be correct, it is evident that this natural force is quite sufficient for the purpose, and therefore, as was stated above, increased crops are possible only through improvements in cultivation, and by the introduction of new methods.

Despite the pronouncement from Java on this subject, many planters are of the opinion that the pollination is effected by insects. It is well known that insects are effective agents in the pollination of many other flowers.

No doubt, when advice is tendered to planters by outsiders, it is well meant, and is probably intended to stimulate discussion and to elicit information. If the result follows that the views of observant and experienced planters are put forward on matters connected with various crops, gratitude is due to those who, although not resident in these islands, have sufficient interest in West Indian industries to offer suggestions for experiment or for practical application, with a view to forwarding the solution of the many yet unsolved questions connected with tropical agriculture

THE FORAGE VALUE OF CERTAIN DESERT PLANTS.

Thers are at least two species of Yucca which are fairly common in these West Indian islands. One of them, *Yucca gloriosa*, is cultivated in gardens, as its flowers freely, throwing up spikes of beautiful, waxy, ivory-white, bell-shaped flowers. The other, *Y. aloifolia*, is probably indigenous to some of the drier islands, such as Antigua and Barbuda, where it is known as 'Silk dagger.' It occurs also in Barbados, where it goes under the name of 'Spanish needle.' The genus Yucca consists principally of xerophytes, as is the case with the two species mentioned above.

Two notes in *Botanical Abstracts*, February 1920, draw attention to the use that has lately been discovered for one of these plants in the great arid plains of Western Texas and the southern parts of Arizona and New Mexico. On these sandy plains *Yucca elata* occurs in more or less abuundance. This species is known locally as 'soap weed' by the English-speaking population, or by its Mexican names of 'amole' or 'palmilla'. The two first names refer to the fact that the roots and stems of the plant may be used as a substitute for soap.

On these arid plains, the greatest difficulty that stock farmers have to face is the occurrence of extended droughts. This has now to a large extent been overcome by the proper use of *Yucca elata* and other related species as a cattle feed in seasons of drought. The dead leaves at the base of the stalk are burnt off, and the remainder of the plants which grow about 3 feet high, are chopped or shredded by recently invented machines. Cattle thrive upon this fodder, and relish it especially when shredded, either fresh, or as ensilage, or in combination with cotton-seed meal. It is stated that full-grown cattle are fed with 20 to 40 lb. of shredded Yucca together with from 1 to 2 lb. of cotton-seed cake per day. With the chopped feed alone 20 to 50 lb. per day will save an ainmal from starvation, but with 1 lb. of cotton seed cake in addition, a fairly well-balanced ration results, by which animals can be kept in good condition and even improved.

The Yucca grows but slowly, and the plant should not be cut too close to the ground if new growth is required. A number of related species are likewise used, chiefly as ensilage, the most valuable of these appearing to be *Yucca glauca*, known as 'bear grass.'

It might be interesting if experiments could be made in some of these islands which likewise suffer from protracted periods of drought, as to whether similiar use might be made of native species of Yucca and other related plants.

CULTIVATION OF SUGAR BEETS IN ENGLAND.

The Field, April 3, 1920, has an interesting article on the subject as to whether it will be profitable to grow beets in England for the manufacture of sugar. Considering the present world shortage of sugar, the subject is an important one, and therefore much of the article referred to is reproduced below. A note in the *Agricultural News*, April 17, 1920, drew attention to the support being given to the project by the Government.

Projects for the development of the sugar beet industry in England have been revived with an enthusiasm that augurs well for the success of the enterprsies, or at least for the thoroughness of the trials. The programme that has been arranged justifies such a deduction. The undertakings as planned will either fulfil expectations or prove the futility of attempting to introduce into England a form of agricultural activity new to the present generation of farmers. There are to be two separate endeavours to establish sugar production in England, one with Government assistance at Kelham, Newark, and another in Norfolk, where the Cantley factory will probably be revived.

The promoters of the schemes start with a store of valuable information at their disposal. The ground for action was largely cleared by the experiments in growing sugar-beet crops, conducted over a series of years in different parts of the country, before the European upheaval became an important factor in the situation. It was proved beyond reasonable dispute that the raw material for the manufacture of beet sugar can be grown in England, equal in quantity and quality to the crops in any other part of Europe. The question that gives rise to whatever apprehension is felt is the cost at which the necessary root crops can be grown, and its relationship to the price which the factory can afford to pay the grower. The earlier enterprises in England, even the Cantley venture of the present century, were not conclusive in their evidence on this crucial point, and its settlement is one of the resuts that may be expected from the renewed efforts to reduce our dependence upon oversea sources for one of the staple articles of human consumption The belief obtains that the success of the Continental sugar factories owed much to a plentiful supply of cheap labour, not in the factories only, but also in the beet fields. Sugar beet entails a considerable amount of labour in cleaning the land before the seed is planted, and afterwards in keeping the crop free from weeds, and in surface cultivation generally. The work required to ensure the healthy development of the roots and in harvesting them would run up a big bill, if the rate of pay were on a level with present statutory terms. Before the war the amount expended in England on these operations was the greatest hindrance to successful competition with Continental makers, who could rely on procuring cheap labonr in abundance, native or imported.

If there were any likelihood of a return to pre-war conditions on the Continent, in the production of beet and the price of sugar, there would, it is to be fearêd, be a poor prospect for the new British industry. But everything points to the improbability of anything of the kind happening. Apart from exchange disturbances, it is believed that the day of cheap labour ou the Continent is past. The workers there are falling into line in respect to the modern demand for higher pay and shorter hours, and the marked change reported from most countries will be noted with confidence by producers, but naturally with misgiving by consumers. The latter cannot count with safety upon cheap sugar in the future, especially if sugar beet is to be a principal source of supply. Labour and the cost of growing the root crops prevent a return to anything near the old prices.

The effect of sugar-beet growing upon the farming systems of a district is also worthy of consideration. The claim that the thorough cultivation required for the beet crops is conducive to the success of the following corn and other crops is well founded. The advantages of the preparations that have to be made for the beet, and the influences of the attention that has to be bestowed upon the growing roots, added to the effect of the strong-rooting beets themselves in breaking up the soil, all tell throughout the full rotation

Then there is the value of the factory refuse for stock food. The dried slices or offal make excellent food for stock of any kind, wholesome and effective far beyond what the bulk of the material would suggest as compared with the ordinary roots they would displace in the ration.

THE SUGAR INDUSTRY OF THE PHILIPPINES.

The condition in the present, the history in the past, and the prospects in the future of the sugar industry in the Philippines are reviewed in an interesting article by Mr. George H. Fairchild in *Facts About Sugar*, March 27, 1920. From this review it appears that according to authoritative records, sugar was exported from the Philippines to the United States as early as 1795.

Some of the cultivated varieties of sugar-cane in the Philippine Islands are presumed to have been introduced from China, and it is possible that others are indigenous to the Islands.

Up to the middle of the nineteenth century, the production of sugar-cane was confined largely to the provinces in Luzon, near Manila, but, following an increased demand from Europe for sugar during the Crimean war, interest in the industry was greatly stimulated, and the development of sugar making extended.

From that time on, up to about the end of the Spanish administration, the industry showed a steady development, the record year being 1893, when approximately 300,000 tons of sugar were exported.

All this sugar was what is known as muscovado, this being the quality of cane sugar in general production throughout the world at that time. Towards the end of the nineteenth century, however, refiners began to insist upon a higher quality of raw sugar from cane than muscovado.

Other cane-producing countries met the refiners' demands by the erection of more up-to-date mills, but the Philippine Islands, for reasons which will be given, continued until within the past ten years to use their native mills. Even now, the bulk of the Philippine crop consists of muscovado sugars, as is evidenced by the estimate of the crop now being produced, of 225,000 tons of sugar, consisting of 150,000 tons muscovados and 75,000 tons centrifugals. The advantages of modern sugar centrals, however, have been brought home to the planters. There are at present twenty in operation and eight under construction or planned for immediate development, and it will not be long before the ratio of centrifugals to muscovados will be reversed.

The political situation of the country towards the end of the nineteenth century undoubtedly retarded the development of the sugar industry.

In view of the political uncertainties of the time, it is not suprising that there was no influx of needed capital to

modernize and develop the sugar industry in keeping with the development that took place in other cane-producing countries. During the first ten years of American occupation, as a result of these unfavourable conditions, the exports of sugar from the Philippines averaged only about one-half of what they had been during the last ten years of Spanish occupation. However, a little later, the introduction of modern sugar centrals stimulated production, which increased considerably, so much so that the year 1916 showed exports of sugar amounting to about 375,000 ordinary tons, the largest in the history of the Philippines.

This favourable showing was mostly due to an exceptionally favourable growing and harvesting season. Since that time production has decreased about 40 per cent., due partly to unfavourable weather conditions, but to a greater extent to adverse shipping conditions arising out of the scarcity of tonnage occasioned by the war, and the high freight rates for such tonnage as was available.

But with the termination of the European war the sugar industry in the Philippines passed rapidly from its critical stage into one of unprecedented prosperity. Then began the era of high prices, unprecedented in the history of the industry in the Islands. The coming year will be even more prosperous than the previous one; this year the producers will get the full benefit of the high prices, and if the outrun of the crop is satisfactory, this should enable them to increase materially their plantings for the next crop.

The future of the sugar industry in the Philippines holds out much promise.

Possibly the Philippines could find the best lesson in increasing sugar production from Japan's policy in rehabilitating and developing the industry in Formosa. When Japan took over Formosa, the Japanese government proceeded to develop sugar making along sound lines, and consequently, the acreage under cane increased in ten years from 65,000 to 225,000 acres and the sugar production from 50,000 to over 300,000 tons. The adoption of improved methods of cultivation has increased the yield of cane per acre from 10 tons to 15 tons, and in many instances to 20 tons; or, in other words, the yield of sugar per acre has increased from 1 ton to $1\frac{1}{2}$ tons with good prospects that it will soon reach 2 tons. A tabulation of the yield of sugar per acre in the Philippines shows that during the past nine years it has only averaged $\frac{3}{4}$ ton per acre, less than half the yield obtained in Formosa, and comparing even more unfavourably with other cane producing countries of the world.

When the tremendous development which co operation of the Japanese government with private enterprise has thus made in the Formosan industry during the past tweuty years is considered, and it is remembered that at the end of the same period production in the Philippines is practically the same as it was at the beginning, it would seem that the Philippine government can no longer afford to close its eyes to the necessity of providing the means to stimulate and increase production in the Philippines.

In time the Orient will look to the Philippines to help meet its increasing sugar requirements. Japan's need of rice has resulted in the restriction of the area planted to cane in Formosa, and the Formosan crop is not therefore likely to exceed in future 300,000 tons. It is also possible that the same need of rice will prevent Java from being able materially to increase her sugar production. The Philippines have sufficient land available to produce more rice than they need, and to double within a short time the present production of sugar without materially increasing the areas now under cultivation to cane.

AGRICULTURE IN BARBADOS.

Last month was the driest April since 1864. In that year only 3 parts of rain were registered at Edgecumbe estate, in the parish of St. Philip. This year on only one day has an entry been made in any gauge book in the island. The very dry weather has been unexpected, as the first two months of the year brought very favourable showers, and there were no signs of the present drought.

The young canes in general are still holding out bravely. Planters say that the B.H.10 (12) seems to be resisting the drought better than any other seedling, and that the B. 6450 is beginning to show signs of exhaustion. This weather is a real test of the preparation both as regards tillage and manuring. The fields to which farmyard manure was applied in satisfactory quantity are pretty sure to hold out best. There is much to be said also in favour of green manuring, but very little of this seems to be done in the island at the present time.

The trashing of young canes does not seem to have made as rapid progress this season as usual. It is said that material is not abundant. The new seedlings do not yield so large a quantity of dry foliage, and this year's yield of trash is less than usual, owing to last year's drought. The use of trash is not, of course, of much fertilizing value; it merely conserves moisture. This being the case, it may be that high tillage and liberal farmyard manuring would, except in the driest districts, obviate the necessity of covering the banks with trash at this season of the year. This, in turn, would enable planters to have a much larger reserve of litter for the forcing of manure for their crops.

At this time, as a rule, it is possible to refer to the satisfactory progress made by the ratoons, but beyond the fact that they have made a start, there is nothing to be said of them.

In the treatment of ratoons, it would be worth while to experiment with the burying of the trash. Under conditions in Hawaii, it has been repeatedly demonstrated that there is no value in merely allowing trash to remain on the surface. The covering of the trash is the important thing.

Rapid progress is being made with the reaping of the crop. It is well that this should be so, for dry tops are much in evidence, and the juice, though not depreciating in quality, is doubtless declining in quantity.

The intensely dry weather has hindered preparation for planting ground provisions of any kind. At this time it is generally possible to state that a few fields of Indian corn have started to grow, and that the spires of early yams are to be seen. The yam crop this year was a moderate one, and, unless rains fall next month, the next yam crop will also be short. Good tillage and heavy manuring will do much for a healthy and satisfactory return of this vegetable, even if planted at a late hour; but an early spring ensures a good general return. Yams of the old crop are now being sold at 13*s.* per 100lb.

Potatoes are rapidly growing scarce, although they are still being retailed at 5lb. for 10c. The young fields of this vegetable are having a hard and trying time, and recently the vines have developed yellow leaves, as though they were reaching maturity. (The Barbados *Agricultural Reporter*, May 1, 1920.)

THE PROPAGATION OF SOME TROPICAL FRUITS.

MANGOES.

In the *Agricultural News*, February 21, 1920, Mr. R. S. Cunliffe, B.Sc., contributed a paper on the propagation of the avocado. In the paper below Mr. Cunliffe deals with the propagation of the mango.

In reviewing existing knowledge on this subject, it is proposed to do so from the utilitarian or practical, rather than the strictly scientific standpoint. This being so, it is advisable, before considering budding or grafting methods as applied to the mango, to review the possibilities of propagation by seed. It must be remembered when treating of the mango, that we have to deal with two distinct types of seed,

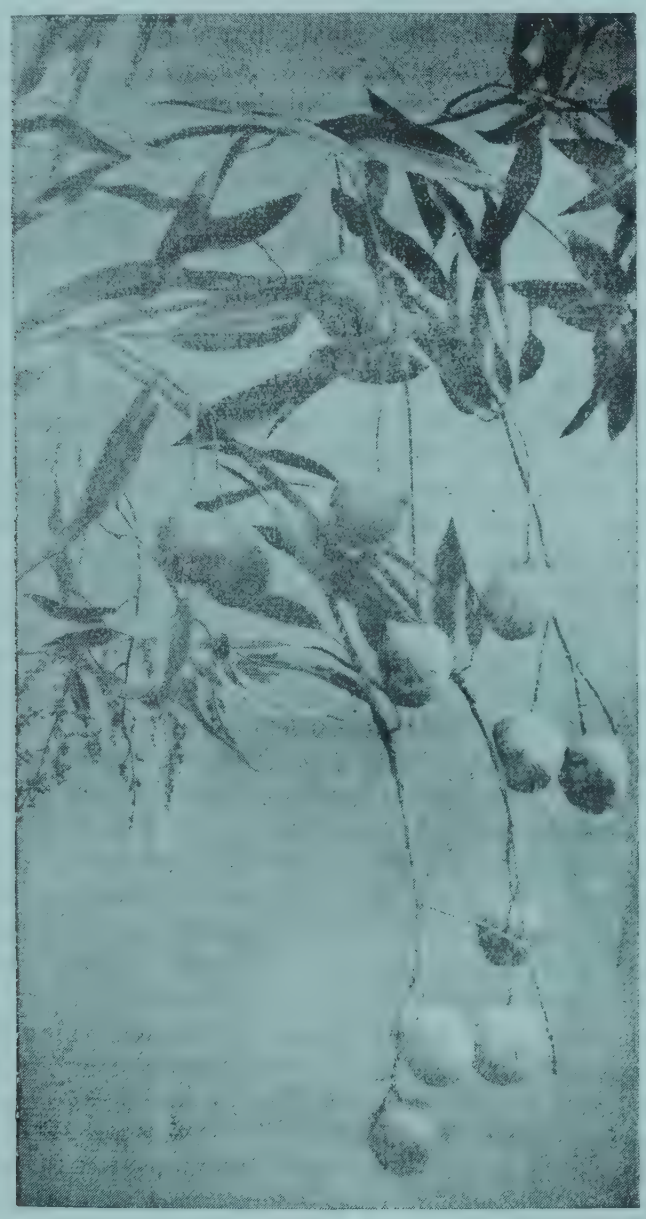

FIG. 4. FRUITING BRANCH OF SEEDLING MANGO.

namely mono-embryonic and poly-embryonic. The former contains only one embryo, which is the product of a sexual process, while in the case of the latter the seed contains several embryos, sometimes as many as twenty or thirty. These multiple embryos have been shown to arise, not from a fertilized ovum, but as buds from the nucellar tissue, and they are therefore equivalent to buds or grafts inserted in the stock by artificial means. From this it follows that it is possible to plant such seeds, and to be reasonably certain that the resulting plant will possess the characteristics of the parent tree. As a consequence of this fact, certain seedling types or races have long been known to exist in some of the West Indian islands and in other tropical regions. Many of such types are justly esteemed for the excellence of their fruits, and some few are known to be but little inferior to the best mangoes of the East. Cuba, as well as Porto Rico are particularly rich in such, the origin of some of which is now lost in obscurity, while such names as 'Chino', 'Filipino,' etc., clearly indicate the source of others. Fruits of several of these bring high prices on the Havana market during the season.

Such seedling types have unfortunately not received the attention they deserve, and are usually found growing in small isolated areas. This is rather surprizing, considering their undoubted merit, and in view of the fact that such trees are probably better adapted to local conditions than imported stock, and are likely to thrive under the conditions of peasant cultivation, where some at least of the finer varieties would perish. It ought to be the policy of all those engaged in mango propagation to assist in the dissemination of such seeds, and thereby raise the standard of the fruit commonly offered for sale.

With regard to grafting or budding processes as applied to mangoes, although propagation by seed is possible in many of the seedling types, the same cannot be said with regard to the mono-embryonic varieties. The embryo in these being essentially the product of a sexual process, differs in characteristics from the parent; and there is no guarantee,, or even propability, that a tree so propagated will reproduce the type of the parent. It is therefore necessary in euch cases to resort to artifical methods of vegetative propagation. As regards the technique, different methods have been tried at several of the tropical stations with varying results. Though it may now be said that shield budding of the mango has been placed on a definite basis, it by no means follows that all the difficulties have been overcome

No matter what system of propagation is adopted, a supply of suitable stocks to work on is essential to success. Select seeds from sound, healthy, and vigorous trees during the season. These are best planted in a seed-bed, where a large number of seeds can conveniently be germinated, and afterwards the best and most vigorous plants should be transplanted into the nursery rows. All weak plants should be discarded. When the young plants have reached the diameter of a lead pencil at the height of 8 or 10 inches from the ground, they are of a size sufficient for budding.

Several methods of budding the mango have been developed from time to time, bnt the only system that warrants attention from a practical utility standpoint, is that of shield budding. In order for this to be reasonably successful, certain conditions must be complied with. First, one of the most important is that of a supply of suitable stocks, as previously stated. When these are transplanted to the nursery rows, they may be forced to develop rapidly by the use of both natural and artificial manures, and a sufficient water-supply. This is one of the practical difficulties in mango budding that must be overcome, if a proper degree of success is to be expected. When plants have reached sufficient size for budding, and shortly before the work is undertaken, it will be found useful in inducing a flow of sap to apply small dressings of from 50 to 100 lb. per acre of nitrate of soda.

The mango makes its growth at periodical intervals, or 'flushes', which usually last for several weeks, and between such periods the tree passes through a state of rest during which the newly made wood is matured. It is necessary therefore for success in shield budding, to make the bud insertions during a period of flush, and as near its beginning as possible, so that ample time may be afforded for a union to take place before the period of vegetative activity passes

Bud wood should be selected from healthy, vigorous trees, and should be from $\frac{1}{4}$ to $\frac{3}{8}$ inch in diameter, with clean, healthy, green coloured bark, taken generally from the second or third flush behind the growing point. It is necessary that this budwood be 'depetioled' at least two weeks previous to being inserted in the stock, so that the leaf scars may be proof against fungus infection. It is also important that the point of insertion be in wood of approximately the same age as the bud. The incision made is of the usual type, and should be at least 2 inches long, while the bud shields should be cut from $\frac{1}{2}$ to $\frac{3}{4}$ inches longer, with the bud about two-thirds of the length from the lower end. This excess of length below the bud serves as a convvnient handle to push the bud into place, and then the excess is cut off at the cross incision in the stock. On no account must the point of the knife be used to push the bud in place, as is commonly done with citrus buds. If the shield is wounded in any way, the bud will die.

FIG. 5. MANGO GRAFTED BY APPROACH.

The buds are wrapped with waxed tape, which contains no oil or grease in the wax composition, and the wrappings are put on to cover the bud completely, and to exclude all moisture from rain or dew. At the end of three weeks the tape may be removed sufficiently to permit of inspection of the buds; if these are still green and fresh, they have probably united.

At the end of another week the wrappings may be loosened to prevent strangulation of the buds, and the top of the stock cut back to 6 or 8 inches above the bud, leaving one or more whorls of leaves.

If the stocks are in good growing condition, in about ten days a number of shoots will appear below the bud, which must be kept rubbed off, so as to force the sap into the bud, and start it into growth. After this has sprouted and matured two flushes of growth, the top of the stock may be cut back close above the bud, and the cut touched with some antiseptic paint. Plants so treated are readily transplanted from the nursery to permanent positions in the field, if this is done during a dormant period, and if the plants are raised with a good ball of earth round the roots.

A method of working over seedling trees, of say five years of age, which has proved highly successful, is that of bark grafting. It is essential for success in this method that the stock be growing well, and the bark must separate readily from the wood without tearing. Such conditions are most readily found in the spring of the year when the sap is rising, and scions inserted at this season usually result in a large percentage of successes.

The scions are selected from healthy trees of the variety it is desired to propagate, by cutting sections of branches, usually from the second or third growth behind the tip. These should be 6 to 8 inches long and $\frac{1}{3}$ to $\frac{1}{2}$ inch in diameter. If the top of each section is formed by a whorl of buds, found at the point of demarcation between two growths, so much the better. The wood of the scions should be mature, but with the bark still green.

The entire top of the stock is removed by cutting through the trunk with a sharp saw at 3 or 4 feet from the ground, being careful that no splitting occurs below the cut. One or more scions are then prepared by making a clean diagonal cut with a sharp knife, beginning about 4 inches from the lower end, and taking care to see that the cut is clean, and free from waviness or splintering. The lower end is then inserted under the bark of the stock, and the scion forced between the bark and the wood with a downward pressure, leaving about 4 inches projecting above the cut.

The whole work is then tied firmly round with strong cord, and waxed over with a good wax which will not run with the heat of the sun, and which will prevent drying of the tissues or the entrance of rain or dew. The work may also be further protected by tying a paper bag over the same, or a paper cylinder filled with clean sand. The waxing however, if properly done, is usually sufficient in the case of mangoes. In three or four weeks the scions should show signs of growth, and will require little subsequent attention. In any case, when failures occur, the work is easily repeated. Trees so treated will produce a surprisingly large top, even in one year.

AGRICULTURE IN TORTOLA.

A copy of the report on the Experiment Station, Tortola, for the quarter ended March 31, 1920, has been received at this Office.

The extension of nurseries for coco-nuts, limes, and grape fruit formed work of importance during the quarter. The sugar-cane variety B.147, a plot of which was reaped at the Experiment Station, appears to be fairly well suited to conditions in Tortola. It is said to be less susceptible to the attacks of borer than the Bourbon variety, and planters are being encouraged to established their fields with it. The possibilities of developing an onion industry on a large and commercial scale are emphasized, and the present position of the cotton industry appears to be encouraging. The cotton fields have given fair results, and in view of the prevailing high price of seed-cotton, in all the British Virgin Islands the peasantry are said to be very keen in clearing up new lands for planting cotton. It is estimated that the acreage under this crop will be doubled in the coming season. With the exception of cotton stainers (*Dysdercus andreae*), a diminution of insect and fungus pests is reported. The revival of interest in the planting of coco-nuts is recorded.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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†Provided by the Imperial Department of Scientific and Industrial Research.

Agricultural News

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NOTES AND COMMENTS.

Contents of present issue.

The editorial deals with certain aspects of, and problems connected with, increased production of cacao.

The insect pests attacking cotton in Egypt are referred to under Insect Notes, on page 154.

Under Plant Diseases, on page 158, the investigations during 1919 in Porto Rico, on the mosaic disease of sugar-cane, are described.

On page 150 there is an illustrated article on the propagation of mangoes.

The first part of an article describing the variegation of leaves in certain tropical plants, will be found on page 154.

A Rare Sugar Found in Honey.

Although known to occur in various forms, melezitose is one of the rarest sugars. Minute quantities of it have been available to scientists, but the supply has never been sufficient to permit of extended experimentations. At present, however, the United States Department of Agriculture has several kilogrammes of this rare substance which, according to the *Hawaiian Forester and Agriculturist*. February 1920, were obtained from crystallized honey stored up by bees in certain districts of Pennsylvania.

The crystallized substance in the honey was found to be melezitose, a word derived from the French name for the larch tree, on which it was originally discovered in the form of honeydew. It also occurs in a sugary incrustation on a leguminous tree in Persia and the neighbouring countries. Recently it has been found in a similiar product on the Douglas fir in British Columbia. And now it has been discovered stored away in the honeycombs of numerous hives in Pennsylvania.

The following origin of the substance in the Pennsylvanian honey has been suggested in the journal referred to above.

The scrub pine and, rarely, other species of pine are subject to attack by a plant louse and by a scale insect. In the course of their life activities these insects produce a honeydew which is rich in melezitose. In dry summers, after the white clover flowers have ceased to yield honey, the bees turn to this honeydew and collect it, but it crystallizes as fast as they store it away. This occurred in 1917 and 1918, and considerable losses were suffered by bee-keepers. In 1919 the weather was so moist during July that no melezitose was gathered by the bees at all. But it probably will be collected in future whenever the summer is dry; and the honey of central Pennsylvania may afford a permanent source of sugar previously so rare as to be only imperfectly known. The Bureau of Chemistry extracted considerable quantities from the honey of 1917 and 1918, and is making extensive experiments with it.

Rare as it has always been, there is a definite demand for melezitose for use in scientific laboratories. It can be distinguished from other sugars by certain peculiarities of crystallization observable with the polarizing microscope.

The Pink Boll Worm in Egypt.

It will be remembered that, at the request of the Egyptian Government, Mr. H. A. Ballou, Entomologist on the Staff of the Imperial Department of Agriculture for the West Indies, recently visited Egypt for the purpose of making a critical investigation of the methods which were being employed there for the control of the pink boll worm. Mr. Ballou was in Egypt from September 1916 to February 1918. At the termination of his work he presented to the Egyptian Government a report on his investigations into the control of the pink boll worm, with an

appendix dealing with the development of the cotton industry in Egypt, and the causes which have operated to bring about a steady reduction in the average yield per acre.

The Egyptian Government, before their publication of the original report, allowed Mr. Ballou to contribute a comprehensive review of it to the publications of the Imperial Department. This review appeared in the *West Indian Bulletin*, Vol. XVII, No. 4. The original report has recently been issued from the Government Press, Cairo. It is an evidence of very careful work, and contains valuable suggestions. The report is excellently printed in bold type, and is well illustrated both with reproductions of photographs, and with carefully executed diagrams.

Pommes de Terre.

This name is, as is well known, the French for potatoes, the tubers of the plant *Solanum tuberosum*. According to the *Kew Bulletin*, No. 2, 1920, the tubers of the 'Jerusalem artichoke' (*Helianthus tuberosus*) were so called in French until the beginning of the 18th century. A French botanist, Frezin, was indirectly responsible for the transfer of the name. He published a book, 'Relations du Voyage de la Mer du Sud aux côtes du Chily et du Peron' in 1716, of which the English translation appeared in 1717. In this book the name 'Pommes de terre,' was first definitely given to potatoes, while Jerusalem artichokes came to be called 'topinambours.'

An Edible Fruit Related to the Avocado.

A note in the *Experiment Station Record*, December 1919, draws attention to an account by Mr. F. S. Blake of the 'anay,' an avocado-like fruit which occurs in Guatemala.

This fruit is referred to the genus Hufelandia under the name of *H. Anay*. The fruit of the 'anay', resembles certain avocados in its ellipsoid-pyriform shape and in general appearance. The skin is smooth, glossy, purplish-black in colour, and is very thin and membranous, adhering closely to the firm, oily, rather scanty flesh. The flesh is said to have a rich, bland flavour like that of a very good avocado, but it is faintly sweetish. The anay grows in moist regions in Guatemala at an elevation of about 10 000 to 12,000 feet. It is believed that it is not likely to succeed in California, but it may do well in Southern Florida. Seedling trees are now being cultivated in the Plant Production Garden at Miami in that State.

Another species of the same genus was collected some years ago in Costa Rica, but whether this also is edible is not stated.

The genus Hufelandia and the genus Persea, to which the avocado (*P. gratissima*) is referred, both belong to the family Lauraceae.

Forking and Subsoil Ploughing.

At a meeting of the Barbados Agricultural Society on April 30, there was a discussion on the question whether the method of forking, as it is at present carried on, is likely to give as good results as subsoil ploughing.

Mr. J. R. Bovell, I.S.O., Director of Agriculture, in opening the discussion, read an interesting paper in which it was pointed out that the proper aeration of the soil was an absolute requisite for the maintenance of its fertility. He emphasized the fact, which has been demonstrated of late years, that the presence in the soil of aerobic bacteria which can only carry on their work in the presence of air, is of the utmost importance for the supply of nitrates to the soil, thus furnishing a sufficiency of plant food.

The reading of such papers at meetings of Agricultural Societies must conduce to the usefulness of these bodies, since they lead to discussions which tend to convey information, and to elicit opinions from persons who are in a position to express them from the standpoint of technical experience.

Industrial Alcohol.

From time to time in the last two or three years, reference has been made in this Journal to various schemes proposed to discover economic sources whence supplies of alcohol for providing power to motor engines, etc. could be obtained.

The Board of Trade Journal, March 4, 1920, publishes the report of a sub-Committee appointed on November 27, 1919, by the Standing Committee on the Investigation of Prices (Profiteering Act, 1919) 'to investigate costs, prices and profits at all stages in respect of Petrol, Benzole, and other Motor Fuels.' The sub-Committee's report, dated February 17, 1920, has now been issued by the Board of Trade.

Among the general decisions of the report, the following relate to the above-mentioned question: 'The sub-Committee find that power alcohol is the only potentially unlimited source of supply of motor spirit; and that the Government should use every possible means to foster the production of power alcohol, and place no restriction on the production and use of power alcohol in the United Kingdom.'

The subject is attracting popular interest in the United Kingdom, as is evidenced by a cartoon in *Punch*, March 10, 1920, with the title 'A Converted Spirit.' The cartoon represents Silenus seated on a cask which bears the inscription 'Alcohol for Internal Consumption,' the latter word having a line drawn through it, and the word 'Combustion' printed below. From the tap of the cask there is flowing a stream of spirit through a funnel into a can labelled 'Motor Spirit,' many similar cans lying near by, while motorists hurry up from all sides. The legend beneath the cartoon is as follows: 'Genius of Alcohol. "And to think that I was once regarded as an impediment to locomotion."'

INSECT NOTES.

INSECT PESTS OF COTTON IN EGYPT.

As is noticed on another page of this issue, the Egyptian Government has recently published the report of Mr. H. A. Ballou, M. Sc., Entomologist on the Staff of the Imperial Department of Agriculture for the West Indies, a comprehensive review of which appeared in the last number of the *West Indian Bulletin*. The following paragraphs are reproduced from that review —

The principal insect pests of cotton in Egypt are as follows :—

Cotton worm	(*Prodenia litura*)
Boll worm	(*Earias insulana*)
Cotton stainer	(*Oxycarenus hyalinipennis*)
Pink bollworm	(*Gelechia gossypiella*)

These are all of different species from the cotton pests of the West Indies, although it will be noticed that three of them have the same common names as the West Indian species which attack cotton in the same way. The boll worm and the cotton stainer appear to have been known in Egypt as pests of cotton since about 1860, and the cotton worm since 1879 : the pink boll-worm is of recent introduction, having been first discovered in 1910.

There is no doubt that any insect which lives in considerable numbers on a crop plant affects its productiveness, either by lowering its vitality or by directly injuring that portion of the plant which is developed as the crop product.

Foaden, writing in 1910, states that 'the boll worm is the most important enemy with which cotton growers have to contend; it is a much more serious enemy than the leaf-eating cotton worm, which only causes serious loss at intervals, and, moreover, can be easily controlled. Furthermore, up to the present, no simple and satisfactory means have been found for checking the boll worm wholesale when it has once invaded a field of cotton.'

In regard to the cotton worm, the same author states, 'This insect is the second in importance of the cotton pests. The total loss suffered by the country from the ravages of this pest, which defoliates the plants, has been very great, since in certain bad cotton worm years the damage to crops has been assessed in millions of pounds. At the same time it must be remembered that such serious outbreaks as these are fortunately rare, and taking the average year, the loss in comparison with the above estimate would be inconsiderable.'

The cotton stainer does not appear to be considered as a serious pest, and no definite steps have been taken to control it.

As far as the effect on the average yield of cotton is concerned, the boll worm and cotton worm seem to be the only insect pests to consider, except for the past few years, when the pink bollworm has undoubtedly played its part.

The development of the cotton industry through the periods of low and medium yields to the maximum in 1897 took place in the presence of these two insects— and it is hardly to be argued that, as their attacks did not prevent the gradual rise in the average yields, they have had any considerable influence in reducing them in the more recent period.

The opinion seems general that both these insects are sufficiently abundant in certain years seriously to affect the crops, and the year 1905 might be quoted, when it is reported that both these species were abundant, the water-supply average and the crop was very short, the total being under 6,000,000 kantars, and the average 3·80 kantars per feddan. Again, in 1909 the crop was only 5,000,000 kantars, with an average of 3·13 kantars per feddan. This was a bad 'cotton worm' year with very good summer water-supply.

This extremely small crop and average yield in 1919 cannot, however, be attributed wholly, or even largely, to the cotton worm, for in spite of severe attacks of this insect a good crop was developed and nearly ready for picking when the very high and early flood of the Nile caused tremendous losses. The soil became saturated with water by flooding and by infiltration, and wholesale boll-shedding took place and reduced the crop enormously.

The cotton bug or cotton stainer (*Oxycarenus hyalinipennis*) appears to have been known in Egypt since about 1860, that is for the same length of time that the Earias boll worm has been known. No record seems to exist as to the exact nature and the extent of the injury caused by this insect to the cotton plant. It is a well-known fact that the cotton bug occurs in great numbers on the cotton plants in every season, and it is generally believed that it causes some injury and some loss in the cotton crop.

For a number of years past the law requiring the eggs of the cotton worm moth to be collected has been enforced, and it has probably greatly reduced the attacks of the insect, but, in spite of this, the average yield has steadily become smaller.

The figures are not available for any statement as to the amount of the damage done by these pests year after year, but it seems safe to assume that they have had nothing to do with the general falling off in yield per feddan for the past twenty years, since they did not prevent the gradual and steady increase in yield in the period of thirty to forty years from about 1860 onwards. Moreover, there is no reason to believe that the attacks of these insects have been more serious in the last twenty years than they were previous to that time.

The influence of the pink bollworm has probably been in the direction of smaller yields since it became established as a pest, but this affects only the past few years, from 1912 on, and has no bearing on the general subject under consideration, that is, the steady falling off in yield for the past twenty years.

SOME TROPICAL VARIEGATED-LEAVED PLANTS.

The following article is contributed to the *Agricultural News* by Mr. W. N. Sands, formerly Superintendent of Agriculture in St. Vincent :—

Many kinds of variegated-leaved plants are cultivated in the tropics for decorative purposes Their striking foliage and charming colour effects add much to the beauty of gardens. The plants chiefly grown are varieties of Dracaena, Acalypha, Codiaeum (Croton), Caladium, Graptophyllum, Coleus, Dieffenbachia, Agave, Aloe, Begonia, Maranta, Tradescantia, together with *Pandanus Veitchii*, *Panax Victoriae*, *Ficus elastica* var., *Furcroea cubensis*, *Aralia Guilfoylei*, *Sanchezia nobilis*, *Cissus discolor*, *Hibiscus rosa-sinensis*, var. *Cooperi*, *Phyllanthus nivosus* ; and others could be named.

In the John Innes Horticultural Institution at Merton, Surrey, under the directorship of W. W. Bateson, M.A., F.R.S., a special study is being made of variegation, and for the purpose of the investigations a large and varied collection of plants from tropical and temperate regions has

been formed. Among the plants the writer noticed several which not did appear to be well known in the West Indies: these will be described at the end of this article.

With regard to variegation in the common tropical types comparatively little is known, so that a study of it in its different forms by reproducing the plants sexually in divers ways, e.g. roots, leaves, stems, etc, and by means of seed along Mendelian lines, offers scope for much useful work at plant-breeding stations in the tropics. Much of this work cannot be performed conveniently in temperate climates, owing to the limited space available under glass, and also to the fact that growth is so much slower. It may be remembered that North American nurserymen regularly sent to the West Indies for stems of varieties of Dracaenas for propagating purposes because they experience so much difficulty in obtaining sufficient supplies of these at home. Again, many interesting varieties of Codiaeums (Crotons) Dracaenas and other variegated-leaved shrubs flower and fruit freely in the tropics, which is not the case elsewhere.

It may be of interest to embody here certain information respecting variegated plants grown in tropical countries, which has been gleaned mainly at the institution above referred to.

The familiar hibiscus (*Hibiscus rosa-sinensis*, var. *Cooperi*) possesses leaves which are irregularly variegated with patches of green, pale-green, white and pink. When the plant is grown from seed, the seedlings are all variegated like the parent. The common snow-plant (*Phyllanthus nivosus*) which first produces on its branches wholly green leaves, and then others which are strikingly splashed with white towards the termination of the shoots, also gives seedlings which all become variegated.

A form of variegation due probably to an obscure mosaic type of disease, and known as infectious variegation, occurs in one of the Abutilons (*Abutilon Thompsoni*). The leaves of this plant are mottled-yellow and dark green. When any portion of the plant is grafted or budded on any wholly green-leaved species or variety of Abutilon, the mottling spreads from the graft or bud to the branches and leaves of the stock, if any of these are allowed to remain. *A. Thompsoni* can also be made to communicate the infection to a white and green variegated-leaved variety, such as, *A Savitzii*. Notwithstanding the presence of the disease, the plant thrives well, and is popular in greenhouses in England.

In the four-o'clock flower (*Mirabilis Jalapa*), a well-known West Indian plant, there is a race the leaves of which are chequered green and white, but some branches may have leaves entirely green: other branches may have only white leaves. Morgan, et al (*The Mechanism of Mendelian Inheritance*, pp. 137-38) summarize Correns' investigations with this plant as follows: 'If the flowers of the white branches are self-fertilized, the offspring have white leaves, and these plants perish for want of chlorophyll. From the chequered branches the offspring may be green, or chequered, or white. When a cross is made between the flowers borne by branches that are unlike, the inheritace is purely maternal. For example, if the pistil of a white branch is fertilized with pollen from a pure green plant, only white-leaved offspring are produced. The reciprocal cross, the pistil from a green branch fertilized with pollen from a white branch, gives only green offspring, and these remain green through all subsequent generations'. In this plant also, the variegation is considered to be due to some sort of disease which is carried over to the next generation by the cytoplasm of the egg. As the pollen does not bring any cytoplasm, the disease is not transmitted through the male side.'

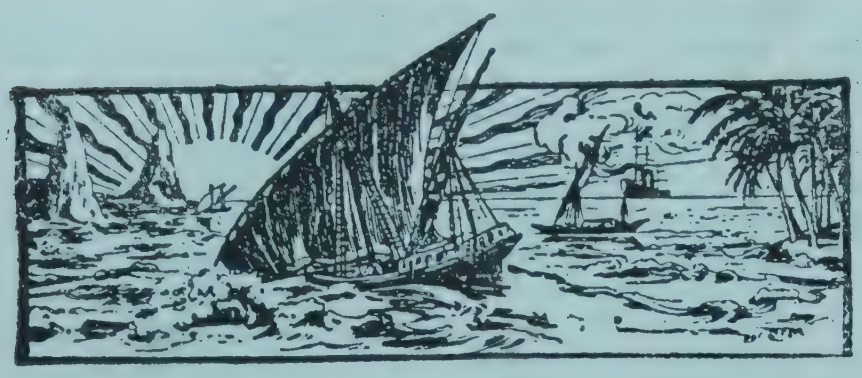
There are variegated types of Indian corn (*Zea Mays* vars) which have been studied genetically in the United States. Lindstrom (*Memior 13*, Cornell University) describes five of these, namely, green-striped; Japonica white-striped; Japonica yellow-striped; Japonica fine-striped and spotted. All behave as simple Mendelian recessives to normal green, with the exception of spotted the inheritance of which has not been fully worked out. In each race the seedlings are green, the striping and spotting appearing in later stages of growth. Lindstrom also discribes certain heterozygous green-leaved forms, which when selfed give, besides green, white or virescent-white or yellow seedlings. The white and virescent-white seedlings quickly die. The yellow may exist for a longer period, but not one has been raised to maturity. On the other hand, a golden-leaved variety which was found in a corn field, and isolated, grows well and produces seed. In this plant the seedlings are all green at the outset, as in the variegated races, the golden character being gradually assumed in later stages of growth. These chlorophyll types, however cannot be classed as variegatsd.

S. Ikono (*Journal of Geneties*, Vol. VI, No. 3.) describes a variegated form of Red pepper (*Capsicum annuum*) which he discovered in 1913 in a pure line. The variegation takes the form of pale-yellow blotches. Besides leaves, stem, petioles, and sepals are marked. The fruits also have yellow patches, and frequently the yellow areas on them are so broad that the green is confined to a few narrow stripes. The variegation, unlike that in *Mirabilis Jalapa* previously described, is transmissible both through the maternal and the paternal sides. This is proved by the fact that when a variegated female is crossed with a green male, and a green female is crossed with a variegated male, the offspring in both cases are variegated forms. When a variegated plant is self-fertilized, only variegated plants are produced.

It has been found that variegated plants having a white sub-epidermal layer extending over a green core, however fertilized, give exclusively white or albino offspring; conversely those having a green skin over white give green offspring only (W. Bateson 'Studies in Variegation I.' *Genetics*, Vol. VIII, No. 2). It is not uncommon to find white-skinned plants giving rise to entirely green branches, but certain cases are discribed (*loc. cit.*) where complete reversal has taken place. In these instances green-skinned over white shoots and leaves, and in others green-skinned over white portions of individual leaves have occurred on white-skinned over green plants. The reversals noted so far were found in non-tropical plants.

Many experiments are being made in propagating variegated plants by asexual methods. Some of the results of this work may be described in a subsequent article. It can be stated, however, that stem cuttings with buds always reproduce the parental form providing the original bud. On the other hand, should adventitious shoots be produced internodally, as has been rarely observed in certain Pelargoniums, then these shoots, if the stem cutting was obtained from a white-skinned plant, would be wholly green, and if from a green-skinned plant, wholly white. Root cuttings, from white-skinned plants give wholly green, as also do leaves, if these are planted without buds and are capable of forming 'eyes' Similarly roots from green-skinned plants would be expected to give rise to albino shoots. This shows that the inner tissues of white-skinned and green-skinned plants are quite distinct factorially from the outer. If roots of sectorial and patchy types could be induced to form buds, then the plant might be either variegated, or green, or white leaved, that is, they would resemble the section or patch of tissue from which they were derived.

(*To be Continued.*)



GLEANINGS.

The exports of honey from Jamaica achieved a remarkable record during the year 1918-19, owing to the demand for it in the United Kingdom. The records show that 1,175 tons of honey were exported, to the value of £154,700. (The *West India Committee Circular*, April 1, 1920.)

The Chilean Nitrate Producers Association, which controls the sale of most of the nitrate productions of Chile, has received orders from Europe for more than a million tons of nitrate for delivery dnring 1920. German steamers, which were interned in Chilean ports during the war, are being utilized to carry the nitrate to Europe. (*Facts About Sugar*, April 3, 1920.)

A variety of yam, known as the Chinese yam or Hausa potato, is a small variety of excellent cooking qualities. Most of the yams are not much bigger than a large potato. The results of experiments with this variety, on the Agricultural Experiment Farm, Sierra Leone, gave a retnrn of over 3 tons per acre, according to the Annual Report of the Agricultural Depaitment of that colony for the year 1917.

The colony of British Honduras was of material use to the Empire in the prosecution of the war, by supplying large quantities of mahogany for making aeroplane propellers. The export of the wood was conserved and controlled solely for military uses. A representative of the Admiralty was present in the colony to make contracts for the purchase of the year's output. (*Colonial Reports*—Annual, No. 1025.)

According to official returns, the prospects of the tobacco crop in Southern Rhodesia this year are exceedingly good. The area planted in this crop, chiefly in Mashonaland, is 6,000acres. Last year the area was 4,000 acres. It is anticipated, moreover, that the yield per acre generally, will be at least 50 per cent. higher than last year, and the quality of the leaf is expected to be the best produced for a number of years. (The *Yorkshire Post*, March 30, 1920.)

The report on the production of tea in India in 1918, recently issued by the Indian Department of Statistics, states that the total area under tea in that year was 678,500 acres, a net increase on the previous year of 11,500 acres. The total production of both black and green teas in 1918 is reported to have been 380,349,000 lb. It is a noteworthy fact that, while the area under cultivation increased by 27 per cent. in the decade 1908-19, the increase in production was no less than 56 per cent. (*The Board of Trade Journal*, March 11, 1920.)

The *Louisiana Planter*, April 3, 1920, states that heavy rainfall, which was very much desired, seems to have occurred throughout Cuba, though perhaps not in sufficient volume to meet all the requirements. A year ago it was predicted that the Cuban sugar crop of this campaign would amount to 4,500,000 tons. Last December this estimate was revised to 4,300,000 tons, and the general opinion at present seems to be that, owing to unfavourable weather conditions, it will hardly be more than 3,900,000 tons.

Sugar-cane varieties remove varying amounts of the vital elements from the soil. It is estimated from analyses of the total cane plant, except roots, made in the Agricultural Laboratory, Queensland, that the variety known as Clark's seedling, sixteen months old, took from the soil 163 lb. of potash, 83 lb. of phosphoric acid, and 96 lb. of nitrogen, while the variety known as Badila, of the same age, took out of the land 139 lb. of potash, 44 lb. of phosphoric acid, and 107 lb. of nitrogen. (The *Queensland Agricultural Journal*, February 1920.)

The *New Zealand Journal of Agriculture*, February 20, 1920, contains a note on experiments made with aluminium honey combs. These metal combs are not merely sheets of foundation, but are Langstroth frames, in which thin strips of aluminium are ingeniously worked into the shape of worker cells. It is claimed that these metal combs tend to greater production of honey, owing to the saving of time in building the wax; also that they extract cleaner, and save the loss of broken combs, destruction by insects, etc. Judging from the results of the experiments, it is stated that these claims do not appear unreasonable.

The necessary yarns for air-craft fabrics are constructed from super fine, combed Sea Island cotton. These fabrics possess the maximum strength combined with elasticity, and are able fully to withstand the immense air-pressure caused when air-craft are flying at the highest possible speed. The production of this fabric is a specialty of the large business of Messrs. Heaton, which operates about 300,000 spindles on Sea Island yarn for manufacture into aeroplane canvas, fine laces, muslins, cambrics, and the best qualities of sewing threads. (Supplement of the *Overseas Daily Mail*, March 27, 1920.)

According to *Facts About Sugar*, April 3, 1920, a large refinery is being erected in connexion with Central Limones in the Matanzas Province of Cuba. The refining plant is to be situated close to the Central, making it possible for the raw sugar to be conveyed to it by machinery, thereby reducing labour expenses. The refinery will have a capacity of some 5,000 barrels of sugar a day, and the plant will also comprise a barrel factory, a bag factory, and a carton factory, so that sugar may be put up in any form desired. The owners of Limones believe that their plans will enable them to put the refined product in a desirable form on the European market.

The Board of Trade Journal, March 11, 1920, states that statistics of the traffic of the Panama Canal during 1919, show that it exceeded that of any previous year, 2,396 ships of 7,128,000 net tons, in addition to naval vessels displacing 1,000,000 tons, having passed through the water-way. The British flag predominated over all others in the total mumber of vessels utilizing the canal from August 1914, when the canal was opened to traffic, to the end of October 1919. During that period 8,618 ships passed through the canal, of which 3,147 were British, 2,910 American, and the rest of other nationalities.

SEED SELECTION AND HYBRIDIZATION OF COFFEE.

At the Coffee Planters' Conference, held at Mysore in July 1918, an interesting speech on improvement of coffee by seed selection and hybridization was delivered by Mr. Rudolph D. Anstead, Deputy Director of Agriculture, Madras. It may be remembered that Mr. Anstead was formerly Superintendent of Agriculture in Grenada.

The speech referred to was fully reported in the *Agricultural Journal of India*, July 1919; and, considering that coffee planting has some importance in the West Indian islands, it seems desirable to reproduce a large portion of it in these pages.

Mr. Anstead said that ever since 1899 a certain amount of work had been done along the lines of hybridizing coffee, with the object of producing a new strain which would bear heavier crops than the ordinary *Coffea arabica*, and be more resistant to disease. A fair measure of success had been attained in this direction in several places, notably in South Mysore, at Chundrapore, and in South Coorg, a very satisfactory hybrid which comes true to seed having been raised on a large scale by a planter in the last named district. The work of producing hybrids, however, is long and tedious, and scarcely suited to estate conditions.

A simpler method of improvement could, and ought to be undertaken by every coffee planter, and that is seed selection. As has been proved in the case of many other crops, persistent seed selection results in great improvement in the strain of the plants involved.

The method of taking coffee seed for planting in nurseries is, as a rule, a most haphazard one. There is no selection about it, and in most cases no one can tell from which trees the seed came, and not always even from which fields. This system is entirely wrong, and probably accounts to a very considerable extent for the deterioration in the strain of coffee, which has undoubtedly taken place in some districts.

The starting point for selection work should be the best tree on the estate, or the best several trees, judged by yield under all circumstances even in bad seasons, by the shape and habit of the tree, by its freedom from diseases, and its resistance to scale insects. A tree like this having been chosen, the next thing to do is to cut out the coffee trees round it, in order to give it ample space, light, and air, and then to make arrangements for netting it when it is in flower. For this purpose four stout posts should be put in the ground at the corners of a 14-foot square, each post about 10 feet high, and a mosquito net made to fit over them so as completely to enclose the whole land. It is a good plan to sew an edge of stout cloth around the bottom of the net, which can be laid on the ground and have earth piled on it so as to prevent it being blown about by the wind. The importance of this netting is to ensure the self-fertilization of the flowers. In the open there is no control over the pollen, and it may come from the worst tree on the estate, but self-fertilized seed will come true in the majority of instances, and reproduce the characters of the parent tree.

As soon as the fruit is set, the net may be removed, and a special nursery be carefully prepared to receive the seed. When the berries are as ripe as possible, they should be gathered and pulped by hand, and only the best seed chosen for planting.

The nursery plants should be spaced widely, and most carefully attended to, and, if necessary, sprayed with Bordeaux mixture to protect them from attacks of leaf disease. When they are ready for planting out, a second selection should be made, and this second selection is most important. Only the very best plants should be planted out; a weakly plant, or one of bad shape, or even a doubtful plant, should be rejected.

The next stage is to select the best three or four bushes, from those planted from the first selected seed, as soon as they come into bearing, and to repeat the process. In this manner each generation would almost certainly be improved, and in course of time a vigorous strain of coffee would be built up. A process of selection of this sort over a period of from ten to twenty years would doubtless cause a great improvement in the yield and health of coffee estates; it would, moreover, be a better plan of rejuvenation than trying to introduce new seed from other countries, which would not be selected seed, and would need acclimatization, and subsequent selection in any case

LONG STAPLE COTTON IN WEST TEXAS.

According to *The Board of Trade Journal*, March 4, 1920, a statement has appeared in the Boston newspapers to the effect that long staple cotton has been grown for the first time in the Southern plains region of West Texas. It has hitherto been believed that the high altitude would militate against any successful cultivation of this crop in that region, but it is now stated that a farmer in the district having planted a small acreage of a long staple variety, obtained a yield of 5 bales, the first bale of which he sold at 62c. per lb.

It is reported that the crop grew exceedingly well from the start, and that the yield per acre was as heavy as that of the ordinary short staple, no special irrigation having been required to produce this result. It is expected that, in view of this initial success, the acreage of long staple cotton will rapidly increase in West Texas.

It must be remembered, however, that the cotton planters of Texas are fighting a great battle against the Mexican boll weevil, which has caused enormous damage to their crops. It remains to be seen whether under such conditions, the probably less resistant long staple type will be able to hold its own.

In a note on the South African cotton industry, which appears in *Production*, March 1920, it is mentioned that the export of cotton from South Africa last crop was 71 tons, while this crop it was 700 tons. The note goes on to point out the probability of cotton being a profitable crop for some years to come. When it is remembered that 500 lb. of cotton was used for making one shell, it will easily be recognized that the shortage of cotton will continue for some time before the enormous quantity used during the war for military purposes is made good.

PLANT DISEASES.

MOSAIC DISEASE OF SUGAR-CANE.

INVESTIGATIONS DURING 1919 IN PORTO RICO.

The following account of research on the mosaic, mottling, or yellow stripe disease is reprinted from the Report of the Commissioner of Agriculture and Labour, Porto Rico, 1919 :—

ENTOMOLOGICAL WORK.

All available time during the year has been devoted to the problem of the artificial transmission of the cane mottling disease by insects. The experimental work was started with the use of a dozen large, outdoor, screened cages containing growing cane, two of them with diseased cane. Insects were first introduced into the cages with diseased cane, and after a variable length of time in these, up to a week, they were transferred to cages containing healthy cane. The cane in the latter cages was then watched closely for a period of over six months, so as to note any evidence of the appearance of the mottling disease on the cane.

Experiments similar to the above have been made by confining large numbers of cane-feeding insects in cages that contained both mottled and healthy cane, then observing the healthy cane to note any evidence of attack by the disease Other insects are being similarly tested.

Early in the year 1919 the division of entomology acquired the use of a glass-covered and screen-sided plant house near the station laboratory, and put it to use with the canes in pots from cuttings (stalk sections) known to be free from the disease, and, as each sprout appeared above ground, it was covered with a glass lamp-chimney, with cloth tied over the top. This, in the greenhouse, simulated as nearly as possible outdoor conditions, at the same time excluding the entrance of insects to the cane. Healthy plants grown in this manner were subjected to the attack of insects that were either collected from mottled sugar cane in the field, or had been reared from, or confined upon mottled cane in the laboratory. Healthy cane plants, that had been subjected to the attack of an insect or of insects from mottled cane in the above manner, were transplanted as soon as practicable to the field in fertilized soil, so as to allow the cane every chance for rapid growth. Whenever possible, the experimentswere performed in series of several plants, so as not to depend upon conclusions drawn from the results of single plants, and with each series one or more plants of the same age, similarly grown under cover, but not subjected to insect attack, were planted in the open as a check on the experiments.

Up to the present time a total of 183 experiments have been made in one or the other of the three methods mentioned above, and seventeen different species of insects have been tested. As more than forty-five species of insects and mites have been recorded by the laboratory as feeding upon, and doing possible damage to sugar-cane, it is plain that there is a large number of cane pests yet to be tested.

Of these 183 experiments, the large majority (173) were with sucking insects, and ten with chewing insects.

Among the numerous plants subjected to the attack of insects that previously had fed upon mottled cane, two plants, have, to date, developed the disease in a virulent form The first to show the disease was one of a series subjected to the attack of the cane fly (*Stenocranus saccharivorus*, Westw.), on March 31, 1919.

The second plant to show the disease was one subjected to the attack, on April 28, of five half-grown to adult specimens of the sugar-cane leaf scale (*Aelerda tokionis*, Ckll.) transferred from mottled cane. This plant was one of a series of four, all treated in like manner, two of which died as a result of a continued attack of the scale, which multiplied enormously, The fourth plant shows at the present time very suspicious signs of mottled disease. It is worth nothing that two of these plants showed, on May 31, 'a peculiar yellow mottling more profuse and quite unlike the mosaic disease, especially on leaves most heavily infected with scale.'

It is hoped that within the next year, when the Division of Entomology has been relieved of the burden of plant inspection and quarantine, and supplied with another assistant, the number of plants that may be subjected experimentally to the attack of insects that have previously fed upon mottled cane may be very greatly increased, as it is believed that only by the means of large numbers of tests can any definite conclusion be reached as to the ability of certain insects to transmit the disease from plant to plant. The large number of negative results from the experiments thus far made may be due in large part to physiological conditions of the plants, resulting from their artificial environment, and these adverse conditions may in the future be overcome by improvement of methods resulting from increased experience in handling the plants under glass. Nor is there any reason to believe that some of the plants more recently subjected to insect attack may not later develop the mottling disease.

PLANT PATHOLOGICAL WORK.

Yellow stripe disease was studied principally to determine its mode of transmission. Various modes of contact between healthy and diseased plants were tried. So far, the disease was positively reproduced in four healthy plants by injecting diseased juice into the lower portious of healthy cane stalks. A total of over thirty-five plants were used in this inoculation experiment, and all, except the four mentioned above, remained free. Field observations of this disease were continually made. The nature of the cause of this disease has not as yet been determined ; this will quite possibly be discovered when the mode of transmission is definitely understood. The work of eradication of yellow stripe disease at the experiment station is carried on under the supervision of the Division of Plant Pathology.

AGRONOMICAL WORK.

The most important factor in the agriculture of Porto Rico this year, has been the continued spread in the cane fields of the island of the yellow stripe or mosaic disease, locally known as 'Matizado'. It is now to be found not only in the west and centre, but along the entire south coast, and it has been recently discovered at Naguabo on the east coast. Fully three-fourths, and probably as much as four-fifths of the cane fields of Porto Rico are more or less invaded by it. Naturally so serious an outbreak has received careful attention, and in co-operation with the Pathological and Entomological Divisions much study has been given to it, and to practical methods for combating it. Great efforts have been made to induce planters to make attempts to eradicate it. Circular No. 14 was issued in Spanish, giving brief but explicit directions for its control. The response to these efforts has been very encouraging. Many centrals and colonos have taken active and intelligent measures to comply with the recommendations.

In every case the results have been most gratifying. It is very difficult absolutely to stamp out an outbeak of this disease, but it is comparatively easy and inexpensive to control it so far that it no longer becomes a menace to the industry.

COTTON CULTIVATION IN CALIFORNIA.

It would appear that the cultivation of long staple cotton in California is likely to be much developed and to prove quite a success. An article in the *Monthly Bulletin of the Department of Agriculture*, California, January-February 1920, points out that, for the ultimate success of the cotton-growing industry, it will be necessary to avoid the mistakes that have been made in the Southern United States and elsewhere.

Four measures are recommended for the benefit of the industry. These are:—

1. To maintain and support the quarantine orders now in force in California against the introduction of cotton seed from other States in which the cotton boll weevil is known to exist

2. To determine and announce the amount and location of supplies of cotton seed in California and Arizona known to be both desirable and available for planting purposes in California next season.

3. To create a premament source of supply of desirable seed for planting purposes, by the establishment of areas in the state for the growing of varieties of cotton best suited to the local requirements, seperate and apart from other varieties, under the supervision of Federal and State cotton experts;

4. The formation of a Cotton Growers' Association for the general protection and promotion of industry, including the inauguration of a system of regular inspection of the growing crops of cotton specifically planted as a source of seed supply, and the ultimate certification of cotton seed offered or sold for planting purposes.

As has been proved in the cotton-growing islands of the West Indies, some such measures as the above are of essential importance for the maintenance of the cultivation of long staple cotton.

It is stated that in California, through the rigid policy of inspection and quarantine which has been carried out, the cotton boll weevil and the pink boll worm, which have so tremendously damaged the cotton industry of the Southern States, have been up to the present excluded; but it must be remembered that unremitting watchfulness must be maintained in this matter.

Another feature of great importance to the cotton industry of California is the preservation of selected strains. The damage that has been done to the famous Egyptian cotton by planting inferior varieties has resulted through crossing with the superior varieties. A degenerated condition of the staple ensued.

An example still nearer home of the injury accruing by neglect of seed selection is stated to have occurred in the cotton cultivation in Arizona, where it is supposed that the partial failure of the cotton crop in some localities must be attributed to the fact that many farmers paid no attention to the quality of the seed sown.

In the face of such examples, the writer of the article referred to above recommends that, if necessry, a legislative Act be passed adopting certain desirable types and strains of cotton for cultivation in the State.

The Federal Government, through its Agricultural Department, has for several years been conducting exhaustive experiments to determine the value of certain types and strains of cotton, and the Department is now in a position to give advice as to the varieties which are desirable and those which are not. Such recommendation should be adopted and rigidly adhered to, all other and inferior varieties being excluded. If all the cotton interests in California would co-operate on the lines suggested above, there would appear to be promise of much future prosperity for the industry.

DRUGS AND SPICES ON THE LONDON MARKET.

Mr. J. R. Jackson, A.L.S, has forwarded the following report on the London drug and spice markets for the month of March:—

GINGER.

The month of March opened with a fair amount of business in the drug and spice markets, with very little variation in prices since our last report for February, though where changes have been made, they have always been with and upward tendency. Thus, in the case of ginger, at the first spice auction on March 4, it was stated that importers of Jamaica had raised their prices by about 30*s.* per cwt. to 140*s.* to 150*s.* per cwt. on the spot, for ordinary grinding quality to medium bold hard. At this same auction, Cochin was represented by 539 bags, all of which were brought in at from 70*s.* to 80*s.* for slightly wormy, and 61*s.* to 62*s.* 6*d.* for very wormy. It was further stated that some sales had been made in Liverpool at 65*s.* per cwt. of ordinary Sierra Leone. At the last auction on the 25th of the month ginger was in quiet demand, medium to good Jamaica being offered at 140*s* to 150*s.*, and common at 130*s.* Very wormy washed Cochin was offered at 60*s.* to 62*s.* 6*d.*, Sierra Leone at 70*s.*, and Japanese at 65*s.* Quite at the end of the month Japanese was obtainable at 64*s.*

NUTMEGS, PIMENTO, CITRIC ACID.

Nutmegs are reported as being very scarce, due, it is said, to the high cost of freightage. Pimento has been slow of sale during the month at a stationary price of 6*d* per lb. At the beginning of the month citric acid was reported to have advanced 6*d.* to 9*d.* per lb., 6*s.* 3*d.* being the price demanded. A week later it had advanced from 6*s.* 6*d.* to 6*s.* 9*d.* and at the close of the month it was stated that as much as 6*s.* 10½*d.* to 7*s.* had been paid.

SARSAPARILLA.

This drug was in good supply at auction on the 12th of the month, grey Jamaica being represented by 23 packages, Lima by 56, native Jamaica by 13, Mexican by 20, and Honduras by 10*s.* Of the grey Jamaica 7 bales were disposed of at 3*s.* 6*d.* to 4*s.* per lb. for good, 2*s.* 9*d.* for part mouldy, and 2*s.* 3*d.* for wormy. The 56 bales of Lima were disposed of privately. The 10 packages of Honduras were held at 6*s.*

MACE.

At auction on the 25th of the month, mace was represented by 155 packages, chiefly West Indian, which were disposed of at the following rates: good 1*s.* 8*d.* to 1*s.* 9*d.*, fair 1*s.* 5*d.* to 1*s.* 7*d.*, ordinary 1*s.* 3*d.* to 1*s.* 5*d.*, pickings 1*s.* to 1*s.* 2*d.*, and broken 8*d.* to 10*d.* per lb.

KOLA, OIL OF LIME, CASSIA FISTULA, ANNATTO SEED, CANELLA ALBA, TAMARINDS, NUTMEGS.

At the beginning of the month West African kola (quarters) was disposed of in Liverpool at 5½*d.* per lb. and at auction on the 12th of the month 3 bags of fai, West Indian halves were disposed of at 6*d.* per lb. At the beginning of the month hand presed oil of lime was quoted at 17*s.* per lb. and distilled at 7*s* At auction on the 12th of the month 19 packages of Cassia Fistula pods were brought forward but found no buyers. Canella Alba bark, which is reported very scarce, was represented at auction on the 12th of the month by 2 bales, but found no buyers, being held at 3*s.* 6*d.* per lb. East Indian tamarinds to the extent of 157 packages were brought forward at the auction on the 12th of the month, but found no buyers. At auction on the 25th of the month nutmegs were represented by 318

MARKET REPORTS.

London.—The West India Committee Circular, April 15.

Balata—Venezuelan Block, no quotations ; West Indian Sheet ; spot, 4*s.* 8*d.*
Beeswax—No quotations.
Cacao—Trinidad, 144*s.* to 150*s.* Grenada, 124*s.* to 130*s.* St. Lucia, No quotations. Dominica, 120*s.* to 130*s.* Jamaica, 121*s.* 6*d.* to 137*s.* 6*d.*
Copra—£58
Honey—No quotations.
Lime Juice—Raw, 3*s.* 6*d.* ; Concentrated, no quotations.
Pimento—6*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T. S. Garraway & Co., April 28.

Arrowroot—$9·00 per 100 lb. duty paid.
Cacao—No recent sales.
Coco-nuts—$52·00 husked nuts.
Hay—Market bare.
Onions—Lottings at $17·79.
Peas, Split—No quotations; Canada, Market bare.
Potatoes—$8·00.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, March 23.

Bay Oil—28*s.* to 29*s.*
Lime Oil—6*s.* 6*d.* to 7*s.* for West Indian distilled, and 16*s.* to 17*s.* for hand-pressed.
Orange Oil—West Indian, 35*s.*

Trinidad.—Messrs Gordon, Grant & Co., May 5.

Cacao—Venezuelan, $25·70 to $26·00 ; Trinidad, $24·00. to $24·50.
Coco-nut Oil—$2;35 per gallon.
Coffee—Venezuelan, $5·50 per famga in bond.
Copra—10½c. per lb.
Dhal—No quotations
Onions—$15·00 per 100 lb. Light stocks.
Peas, Split—$10·00 per bag.
Potatoes—English, $8·00 per 100 lb.
Rice—Yellow, $13·00 to $13·50. White, $14·00 per bag.
Sugar—No quotations.

New York.—Messrs. Huth, Gillespie & Co., Inc. April 9.

Cacao—Caracas, 22c. to 22½c.; Grenada, 19¼c. to 19¾c. ; Trinidad, 20½c. to 21c. ; Jamaica, 18c. to 19c.
Coco-nuts—Jamaica selects, $57·00 per M; Trinidad $56·00 per M; culls, Jamaica, $34·00 ; Trinidad $34·00 per M.
Coffee—Jamaica, 18c. to 24c. per lb.
Ginger—28c. to 35c. per lb.
Goat Skins—Jamaica $1·50; Antigua $1·50 ; Barbados No quotations; St. Thomas and St. Kitts $1·40
Grape Fruit—Jamaica, $2·25 to $3·75.
Limes—$7·00 to $8·00
Mace—37c. to 39c.
Nutmegs—26½c.
Oranges—$6·00 to $7·00.
Pimento—8½c. per lb.
Sugar—Centrifugals, 96°, 16¼c. c. & f. ; Muscovados, 89°, 14¾c.; Molasses, 89°, 14c.

Special Selected Sea Island Cotton Seed

— FOR —

PLANTING PURPOSES.

We can supply you with the above, selected from S eed grown at the Government Industrial Schools, and the Lunatic Asylum Farm, under the supervision of the Agricultural Department. Lint from this Seed has been highly reported on by the Spinners in England.

WE SOLICIT YOUR ORDERS. ☚

The Barbados Co-operative Cotton Factory, Ltd.

WHITE PARK.
May 15, 1920.

AGENTS FOR PUBLICATIONS OF THE IMPERIAL DEPARTMENT.

London: Messrs. Dulau & Co., Ltd., 34-36, Margaret Street, Cavendish Square, W.
West India Committee, 15, Seething Lane.
Barbados : Advocate Co., Ltd., Broad Street, Bridgetown.
Jamaica : The Educational Supply Company, 16, King Street, Kingston.
British Guiana : The Argosy Co., Ltd., Georgetown.
Trinidad: Messrs. Muir-Marshall & Co., Port-of-Spain.
Tobago: Mr. C. L. Plagemann, Scarborough.
Bahamas: Mr. N. D. Sands, Board of Agriculture, Nassau.
Grenada: Messrs. Thos. Lawlor & Co., St. George
St. Vincent: Mr. Floris Simmons, Experiment Station.
St. Lucia: Mr. R. W. Niles, Botanic Station.
Dominica: Mr. J. R. H. Bridgewater, Roseau.
Montserrat: Mr. W. Robson, Botanic Station.
Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre.
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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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The Price of Sugar.

THE enormous rise lately in the price of sugar has attracted general attention, and is the subject of much discussion. Most people seem to consider that the rise in sugar prices has been much greater, relatively, than in the increase of prices of other commodities. Especially does this seem to be the opinion inplaces like the West Indies which produce sugar themselves.

This rise may be regarded as having taken place in two phases. Up to about the close of last year the rise followed that of the cost or value of other commodities: early in the present year it became evident that there would be a considerable shortage of sugar on the world's markets, while contracts had already been made for the sale of a very large portion of the visible supply. In consequence of this the price of sugar advanced very rapidly; it virtually doubled in the course of a few months as the result of purchases made at considerable disadvantage by those who found themselves short of sugar. Had the position remained what it was about the close of the year, it might be reasonably argued that the price then being realized was one which might be expected in view of the general position as regards the world's supply of foods. The present very high prices, however, must be regarded as abnormal, as being due to a large extent to a suddenly discovered shortage, and to be such as are not likely to be long maintained.

Turning, however, to the prices obtaining at the close of last year, when large quantities of sugar were sold at somewhat under £40 per ton at the port of shipment, it may be argued that these prices, though high, were not unduly so, when all the circumstances are taken into account.

According to statistics issued by the United States Bureau of Labour, it appears that from January 1919 to January 1920 the price of sugar has advanced 65 per cent. At the same time the prices of other commodities also increased considerably. If, however, we compare the prices of food products in the years from 1914 to 1919, it is evident that the prices of meat, eggs, milk, bread, vegetables, and practically all food products increased in greater proportion than the price of sugar. The

same is true also of almost any one of the necessaries of daily life. The conclusion is that sugar is only now coming up to the level of the increased prices of commodities in general.

Taking a longer outlook in the past, it may be seen that while the general level of prices for food and other commodities has been steadily rising since the beginning of the century until 1914, the price of sugar was moving downwards. In an article on the subject, in *Facts About Sugar*, April 24, 1920, it is stated: 'In the decade from 1900 to 1910, while the prices of food products advanced 49 per cent., the price of sugar declined 7 per cent. From 1890 to 1910 the average advance in all commodities was 14·5 per cent. but the price of sugar fell 14·7 per cent. From 1910 to 1914 the movement of sugar prices was still downward, carrying them in many sections below the actual cost of production, while other commodity prices continued to advance. Thus the rise in the price of sugar since 1914 has proceeded from an abnormally low point, while the rise in other prices has proceeded from a level that already was very high in comparison.'

It is to be remembered that sugar is a commodity in demand throughout the world; its price therefore, is normally determined by the relationship of supply and demand throughout the world. Under war conditions it was possible by government control to restrict the market value of sugar to less than might have been obtained under free conditions. With the removal of these government restrictions on international trade, sugar is now responding to the balance between demand and supply. The existing high price of sugar is explained by the fact that both during and since the war the world's production of sugar has decreased, while the world's demand for sugar has increased.

From current estimates of the production of sugar from the crops of 1919-20 the world's supply for the current year will be more than a million tons below that of the previous season, and more than three millions less than the crop of 1913-14, the last year of normal production. The fact now is that such stocks of sugar that used to be carried on from one season to another have been so absorbed that the world's market is without reserve supplies, and is at the present time dependent for its supply on each annual crop.

Such conditions make the rise in price understandable, and only by the gradual process of increased production can a return to a lower level be expected. In the interest of the sugar industry it is to be hoped that this lower level will not sink to that of twenty years ago, but only to one that will satisfy the enlarged requirements of a world that is continually demanding more and more sugar.

In the case of such a commodity as sugar, which is in worldwide demand, high prices tend to correct themselves. When prices are lower in one market than in others, as was the case in the United States during the war, there is nothing to attract outside sugar to that market. When, however, prices rise to such a point as to be higher than in other markets, such a market attracts sugar from countries which have available supplies. It is stated in *Facts About Sugar*, April 17, 1920, that the process has begun in the sugar markets of the United States, so that sugars from Java, the Philippines, South America, and even from Germany, have been offered in New York. This of course, may be largely due to the question of money exchange; for countries, though perhaps themselves not adequately supplied, may find it to their advantage to get rid of some of their stock of sugar so as to obtain foodstuffs, or raw materials urgently required for their industries. Consequently, there is a tendency to ship sugar to the market where the highest price is offered

Another way in which high prices tend to correct themselves is by the automatic limitation which they impose upon consumption. Nowadays, the prevalence of high wages paid to workmen, and the consequent tendency to freer expenditure on their part, an increase of cost in such an article as sugar may have less effect upon the majority of consumers than it would have had formerly. Still, however, such an immense rise in price in a short time can hardly fail to exert a material influence in the limitation of the consumption of an article thus enhanced in value. Apart from the consumption of sugar in large jam and candy factories, it is certain that a vast amount of sugar is used normally for making preserves in the ordinary home. Now that sugar is being retailed at more than a shilling per pound, the ordinary housekeeper is almost certain to restrict her domestic jam and preserve making. There will also be practised in ordinary

households greater economy in the table and culinary uses of the product. Although so-called substitutes, such as saccharine, may be largely advertised, as being an economical method of obtaining a sweet taste without real sugar, it is not likely that they will attain any lasting success.

The two influences alluded to above, namely the movement of sugars from all parts of the world to the markets where they are in demand, and the restriction of consumption by the majority of consumers, are certain ultimately to produce a balance between supply and demand. In this way, too, production will be stimulated to such an extent as to bring about a lower price for sugar. From one point of view the present high level of sugar prices, though bearing heavily upon the consumer, appears to be, to the great advantage of the producer. This change from the artificial low level of sugar prices in the past also tends to the stimulation of increased production, by enabling sugar manufacturers and planters to expend capital in the improvement of their machinery and in the cultivation of their land.

ASBESTOS CEMENT.

An interesting article was published in *The Times* Trade Supplement, March 20, 1920, calling attention to a new constructional material which would appear to be of particular value for tropical use. The following paragraphs are quoted from the article referred to above.

The material in question is asbestos cement, or perhaps it might be more appropriately called asbestos concrete, seeing that it is a concrete with one striking divergence from the usual practice. Instead of the aggregate being rock rubble, shingle, or some other similar material, it is asbestos associated with cement, producing a substance entirely different from any other material hitherto employed in constructional operations.

The war having conclusively established the value of this building material, it has been decided to carry on the manufacture of the product in all its many phases in England upon a comprehensive scale

The fact that asbestos at present is a somewhat expensive commodity, the prices for the qualities adapted to textile use ranging from £400 to £1,000 per ton, may lead to the inference that asbestos cement is likely to prove an expensive product. But this is not so. The young industry in question absorbs the asbestos waste from the mills and mines— the short odds and ends commanding little or no industrial value —and this waste can be purchased at about £30 a ton.

The process of manufacture is somewhat interesting, being reminiscent of that followed in the making of cardboard. Indeed a modified paper-making machine is employed for the purpose. The aggregate is first reduced to pulp in the beating engine, stored for a while in a vat, and then led to the sheeting machine, where the actual fabricating process is identical with that relative to cardboard. The material is produced in a continuous length upon the blanket, and to any desired thickness, merely by adjusting a number of layer delivered from the revolving depositing drum.

In the sheet form its applications are extremely varied, since it can be used as a substitute for many accepted materials. The fact that it can be sawn and chiselled is said to render it a substitute for timber; in fact its recognition as artificial lumber represents one of its widest uses. The intention is to utilize it as a house building material for frame buildings. The vertical timbers can be of oval, square, or cylindrical section, and sunk into cement concrete foundation blocks, with the external walling in the form of the familiar weather boarding or panels nailed or screwed to the former. The roof can be covered with the selfsame material, either in imitation slates or tiles, since they can be cut to the desired shape, and finished in any colour.

Absolute permanency is assured in either case. The material is cheaper than slates or clay tiles, the advantage in respect of the former being one-half the cost with one-third the weight.

The interior of the building can be finished off with asbestos cement walls, coloured to any required shade according to architect's specification. The ceiling can be covered with embossed sheeting. If required, timber can be eliminated entirely from the building. Such a house, as will be realized, virtually coincides with the requirements of being fireproof, inasmuch as tests have proved asbestos cement to be capable of resisting a temperature of 800° Fahrenheit.

Moreover, the material is vermin-proof, damp-proof, and capable of withstanding all the vagaries of weather. For tropical purposes it has been found ideal, inasmuch as it offers complete resistance to the attacks of insects and other animals which wreck such havoc with wood.

So far as pipes are concerned, it has been found capable of displacing iron or steel to a very pronounced extent, and it can be made with equal facility in narrow diameters, for the supply of water and gas, or up to 20 inches and more for the handling of sewage. It is much lighter than iron, as well as being cheaper, while under test it has been found capable of withstanding a pressure up to 400 lb. per square inch. The material is in demand abroad for irrigation and sewage as well as for domestic water-supply purposes, since, if buried, it is resistant to decay, while if exposed to the atmosphere and weather, it cannot rust or decompose, and does not require periodical painting or other preservative treatment.

One of the most striking advances in this development is the use of a process for rendering the material a substitute for pottery and ceramic tiles.

Upon the Continent the uses of the material are extremely varied. It has been used in France for the manufacture of gramaphone records, serving as the base for the material carrying the sound waves. One of its most extensive applications has been as tops for tables and cabinet work. It has also been employed as a substitute for tin in the canning of jams and similar products, being cheaper than tin as well as more durable than cardboard cartons, or glass and earthernware. One of its most beautiful applications is in the fabrication of mosaic, for which there is a big demand, and to satisfy which special arrangements are to be made.

DEPARTMENT NEWS.

Mr. T. G. Mason, a graduate of Trinity College Dublin, has been appointed Economic Botanist on the Staff of the Imperial Department of Agriculture. It is expected that Mr. Mason will arrive in Barbados to take up the duties of his appointment some time in July.

SUGAR INDUSTRY

THE ELECTRIFICATION OF SUGAR MILLS.

Among the developments that are taking place in the manufacture of sugar is the application of electric power to the mills and their adjuncts.

An article in the *Cuba Review*, March 1920, gives an interesting account of the progress that is being made in many factories in Cuba in the above direction.

It has been only a very few years since electricity as motive power has been applied to the sugar industry. Of course, for many years previous to the first application, electric installation had been made in all moderate sized and large mills for the purpose of furnishing light to the mill and surroundings, but this was the extent to which it had been employed.

Gradually, however, it was used for the operation of all of the subsidiary units of the sugar mill, such as pumps for various purposes, the crystallizers, the cane and bagasse carriers, return pumps, etc. Probably the first mill at which all the accessories of this character were completely electrified was Central Guanica, Porto Rico, in the crop of 1898-99.

The economic conditions of the sugar planters and mill owners of Cuba, from the beginning of the 20th century, until about 1912, were such as to prohibit consideration of the installation of new machinery, or changes from the old system to a new, involving considerable expense.

From about 1909, a Cuban electrical engineer, Señor Antonio Vasquiz, began to study the possibilities of the application of electricity as the motor power of the machinery in sugar centrals. In 1914, the first central to substitute electricity for steam power throughout was Amistad, under Senor Vasquiz's direction.

In this case the motors proved to be capable of all that was required of them; the mills were operated without friction or hitch of any character, and it was demonstrated that, except for the operation of the electric generators, and the need of a certain quantity of exhaust steam for furnishing heat for evaporation, etc., the steam engine has had its day in sugar mills.

Since then many other Cuban centrals have been completely electrified, and it seems likely that for all new large mills, electricity will in the future be the motive power.

Among the advantages claimed for the electric operation of sugar mills are the following: greatly decreased operating expenses, due to practically the entire elimination of the necessity of purchasing fuel with which to supplement the megass; a great decrease in maintenance charges, due to the very much lessened need of overhauling and repairing the various motor units after and during each crop; a considerable increase in production, due to the possibility of increasing the percentage of maceration; and a much greater ease of operation, and flexibility of control, with consequent greater reliability of service.

The above advantages refer to the electrification of the accessories of the sugar mills as already referred to. With special reference to the electrification of the crushing and grinding plants, the following advantages may be cited. In very few sugar factories is each set of mills operated by an individual steam engine, as frequently there are combinations of two and even three mills operated by one high-powered engine. When electrified, however, each mill is operated by its individual motor, and in this way the velocity of each mill can be changed better to suit the quantity of cane which it is desired to pass through the rolls, and to correspond to the percentage of fibre in the cane, and the percentage of water of maceration that is used. Also, when electrified, any mill can be cut out from the system at any time when found necessary, and the rest of the pant can go on operating as usual. In a similar manner the risk of breakage is very much lessened, or, if might almost be said, entirely removed, as the momentum of the crushers, combined with the force of the electric motor moving the same, is not sufficient to cause breakage, if through any circumstances excessive accidental resistance is occasioned. This, of course, is not the case with steam driven mills, as the power of the engine, especially if two or more mills are operated by the same engine, combined with the momentum of the large fly wheel always found in such installations, is more than sufficient to cause breakage under the above circumstances. Furthermore, a small additional motor is sufficient to serve as replacement for the motors. Also the dimensions of gears and pinions in all the motors can be the same, thus causing these to be interchangeable, facilitating repairs or replacements, something which cannot be the case with mills operated by steam engines. Minor economies also are brought about through the consumption of much less oil than can be the case with steam engine operation The elimination also of all piping for the conveyance of direct steam is a source of economy in the original installation, and this, in combination with much greater compactness and cleanliness of operation are points which favour electrification.

THE MAPLE SUGAR INDUSTRY.

An interesting account of this industry in Canada, and the United States, occurs in *Canada*, May 1, 1920, from which some extracts are reproduced below.

In the north eastern quarter of the North American continent occur several species of maple trees, the sap of which can be concentrated to a saccharine syrup, or, further, into crude sugar of a characteristic flavour much enjoyed by those accustomed to it. On account of this flavour, due to some substance as yet unidentified, this crude sugar commands a price considerably higher than that of refined sugar. Maple syrup and maple sugar are to be classed rather as sweetmeats than as staple foods.

Chief among the sugar-making species of maples is *Acer saccharum*, Marsh—the hard maple, rock maple or, sugar maple. This tree, besides yielding the best of sap, produces a most valuable wood, strong, hard, tough, heavy, and sometimes beautifully grained. Landscape, bird's-eye, and curly maple are among the handsomest of veneer woods used in the manufacture of household furniture and in the panellings of railway carriages.

Maple sugar making is practised more or less from Arkansas, Tennessee, and North Carolina to the northern limit of occurrence of the tree in Northern Ontario and Quebec, and from Manitoba and Kansas to the Atlantic Ocean.

The maple industry dates back to the pioneer days of French and English settlement in North America. No doubt the Indians knew of the sweetness of maple sap and it seems probable that they had made small quantities of syrup and sugar. It is said that the Ojibwa word for maple sugar means 'drawn from wood (or tree)' and that some tribes had spring festivals known as

'maple dances.' Having no metal vessels, the Indians certainly did not develop anything resembling an industry. Early literary references to the sap and its products do not imply that syrup or sugar was made in quantity. Indeed, the earliest references refer only to the sweetness of the sap.

The primitive method of tapping was to gash the tree with an axe. The modern method is to bore one or more holes, 1 or 2 inches deep, with a $\frac{3}{8}$ or $\frac{1}{2}$ inch bit. Into the hole is driven a metal spout, which usually carries a hook, upon which a bucket is hung to catch the dropping sap.

Maple sap is a dilute aqueous solution of sucrose, salts and albumen. Such a solution constitutes an ideal culture solution for micro-organisms, and the sap is subject to nearly as many and as diverse diseases as is milk. Drawn from the tree, and stored under aseptic conditions, maple sap will keep perfectly for years, even with free access of air. But in practice it becomes more or less infected with bacteria, and moulds, and deteriorates rapidly in such a manner that the best grade of syrup can only be made by boiling the sap the day it is drawn from the tree, or at latest the following morning. The most common forms of organisms present in maple sap, it appears, are the fluorescent bacteria, and these affect the colour rather than the flavour of the sap.

Certain specific organisms, believed to be new species, render the sap stringy, and affect the flavour and clearness like the moulds and non-fluorescent bacteria. Sap affected by any of these diseases is popularly termed 'sour' although its acidity is, as a rule, not more than normal.

CAMPHOR GROWING IN THE BRITISH EMPIRE.

Prof. P. Carmody, formerly Director of Agriculture of Trinidad, contributed to *The Times* Trade Supplement, April 10, 1920, an article on the above subject.

Although this subject has been dealt with in previous numbers of the *Agricultural News*, the opinions of Professor Carmody who is conversant with West Indian conditions seem worthy of attention. Most of the article referred to is reproduced below.

The present high price of camphor invites attention to the possibilities of production within the Empire. Refined camphor is quoted in the price lists at about 2*s*. per oz., and 23*s*. 6*d*. per lb. The price fluctuates enormously; five years ago the price per pound was little more than the price per ounce is now; and as the production is practically monopolized by Japan, the price may be continually raised until consumption is checked by excessively high cost.

The world's requirements of camphor are estimated to be about 10,000,000lb. annually. The demand is increasing, notwithstanding the very serious obstacles to trade in a commodity liable to great fluctuations in price.

Supplies of commercial camphor come chiefly from Formosa, and the industry has been carefully fostered by the Japanese Government. If it be true that the camphor is obtained there by distillation of the wood, the annual destruction of trees must be very considerable, and this may account for the reports of diminishing supplies.

Within the Empire some serious, but so far not commercially successful, attempts have been made in camphor cultivation. Ceylon can claim priority in this direction. The tree was introduced there in 1852, but nothing more was done until 1893, when a consignment of seeds was obtained from Japan. The seedlings from these were distributed among plantations in different parts of the island, and from these about 1,000 trees were successfully grown. The results of this experiment were published in 1901, and it was shown that the growth of the trees was satisfactory at elevations varying from 250feet. to 6,000feet. above sea-level, and that the yield of solid camphor from fresh prunings was about $1\frac{1}{2}$ per cent. It was estimated that the yield of prunings (6 inches to 8 inches long) would amount to 56,000lb. per acre per annum, and that with camphor at 2*s*. a lb, the net profit per acre per annum would amount to £74.

Notwithstanding this favourable estimate the production of camphor in Ceylon has not been a commercial success. It was stated in 1906 that over 100 acres were under cultivation, and that up to that year not more than 1 ton of crude camphor had been produced. At that time the wholesale price of refined camphor was about 4*s*. a lb., which on the above estimate of yield should have given a profit of nearly £150 per acre. At the present price of camphor the profits should be enormous.

In the Federated Malay States experiments are being carried out at the present time, and the distillation tests have shown a satisfactory yield.

In Mauritius the growth of the tree is satisfactory, but on distillation the prunings yield an oil which on analysis is shown to differ from the camphor oils of commerce; what is still more unsatisfactory, no solid camphor is contained in the distillate. From the point of view of future cultivation this is very important, for it has been recently confirmed in Trinidad, Dominica, and St. Vincent that some trees yield only oil and no solid camphor. A tree at St. Vincent is said to be over 100 years old, and does not yield solid camphor

In Trinidad Professor Carmody has had an interesting experience with camphor trees. In 1908 some 200 young trees were found in the Botanic Gardens making such poor growth that it was decidedto clear them out to make room for other plants. Although the soil was known to be poor, the growth was so stunted that it was concluded that camphor cultivation could not be recommended in Trinidad. Fortunately, it was decided to transplant about fifty of them into a better soil at the new Experiment Station. Here the growth was quite satisfactory, and a normal yield of solid camphor has been obtained on distillation. Its bushy habit of growth, and being an evergreen in addition, suggested the utility of the camphor tree as a wind-break, and as wind-breaks are of great importance in cacao cultivation, camphor trees could be advantageously substituted for the trees and plants (of no economic value) now used as wind-breaks.

In Dominica, plants obtained from Trinidad in 1911 have made satisfactory growth, and have yielded solid camphor.

The successful cultivation of camphor within the Empire is no longer doubtful. Hitherto no persistent effort has been made, owing probably to the great fluctuations in price. But the present high price of crude camphor (£31 per cwt. in Formosa), and the reported depletion of the native forests offer great inducements for further efforts within the Empire.

For future undertakings a few precautions are necessary Seeds or seedlings from trees that yield no solid camphor must not be used under any circumstances, stiff clay soil must be avoided, not more than 300 trees to the acre should grown in good average soil, or not less than 12 feet apart in hedgerows, and a sufficient area (from 100 to 500 acres, if possible) for economical distillation. When the trees are four or five years old they can be clipped, and thereafter three or four times a year.

COTTON NOTES.

SEA ISLAND COTTON MARKET.

The Report of Messrs. Henry W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended April 24, 1920, is as follows:—

ISLANDS. Since our last circular report of March 20, the market has been very quiet in consequence of the very limited offerings, the crop having been nearly all disposed of. The sales during this period have been limited to a few small lots of Fully Fine, bought on account of the Northern Mills, on a basis of $1·05, f.o.b, and frieght, and the following crops of Extra Fine for export, viz. 12 bales, Dwe @ $1·50, and 9 bales Bleak Hall at $2·00, the latter being the finest cotton grown. There is now left unsold only five Planters' crops aggregating about 60 bales, which are firmly held at $1·25 to $1·50, and a few odd bags of Fully Fine.

We quote, based on the last sale, viz;—

Fine to Fully Fine @ $1·05, f. o. b. and frieght.

Fine to Fully Fine, off in preparation, @ $1·00, f.o.b. and freight.

GEORGIAS AND FLORIDAS. The Savannah market has been bare of offerings for some time, the sales reported being cotton received from the interior, or from stocks held by exporters. The buying has been on account of the Northern Mills. The Factors have had little to offer, and such sales as have been made by them have been at very irregular prices. Consequently it is difficult to quote the market. There continues a good demand from the Northern Mills for average Extra Choice, which has not been fully supplied, and if a desirable lot was offered it would be taken at a sharp advance. The stock on hand in Factors' hands is very small and generally held off the market, and the stock held by exporters is party sold and awaiting shipment.

We quote, viz:—

Average Extra Choice @ $1·10 to $1·15, f.o.b. and freight.

The unsold stock is held higher.

The exports from Savannah since March 20 have been, to Havre 100 bales, Northern Mills 108 bales, Southern Mills 328 bales, and from Jacksonville to the Northern Mills nil.

ACREAGE. We have not been able to get any reliable information as to the acreage planted, and probably will have to wait for the Government's report later on. However, from advices received to date, we can report that there will be a considerable reduction in all three States. Consequently the outlook is for a crop smaller than this crop, which will not exceed 7,000 bales. The buying this season has been very largely from stock brought over from previous years, viz. 1917-18 and 1918-19.

INDUSTRIAL POSSIBILITIES OF BRITISH EAST AFRICA.

The Board of Trade Journal, April 8, 1920, contains some extracts from the Report of the Economic Commission which has been investigating market and other conditions in British East Africa, There are indications of great future prospects for the country, which is capable of almost indefinite progress in the production of many crops, chiefly tropical, as will be seen from the extracts below.

It is pointed out that its comparative lack of concentrated water-powers, and probably of coal, its immense capacity for primary production, its geographical position, and the nature of its peoples preclude it from any important manufacturing development in the immediate future.

East Africa's real significance to the Empire lies in the fact that many of its main products, such as sisal, flax, coffee, and cotton, are products for a supply of which the Empire depends mainly upon foreign sources; while other of East Africa's products, such as maize, barley, hides and bacon, are supplementary to a present Imperial production insufficient for Imperial needs.

The native population live mainly on varieties of grain produced in the country Maize is the principal crop. The Director of Agriculture estimates that no less than 250,000 tons of maize are produced annually. There is in normal times a substantial export of maize. The returns of the District Officers indicate that at least 100,000 tons of other native crops are produced and consumed annually; but this figure is probably too low, as the returns are incomplete. Bananas, sweet potatoes, and sugar-cane also are in many districts among the chief constituents of native diet. Local requirements in wheat, potatoes, rice, beans, peas, and other vegetables are wholly or partially met by local production.

The West India Committee on Sugar has estimated that British East Africa should produce 500,000 tons of sugar a year.

The area under flax is believed to be about 4,000 acres. A much larger area would probably have been planted but for the difficulty of importing machinery. All that is wanting to enable East Africa in the near future to grow all the flax that can be required of her is increased settlement, and organization of the labour-supply.

There are over 20,000 acres under sisal. Planting is proceeding rapidly, and the output of the country should very soon be 15,000 tons per annum.

Almost all known varieties of oil seeds can be grown in this country; but sim sim, or sesamum, is the only variet which has hitherto been raised on a large scale. Castor seed, cotton seed, grape seed, and linseed, as well as ground nuts can also be grown.

Lemons and limes of the highest quality are grown in most parts of the country with great success. There are possibilities in the manufacture of citric acid and citrate of lime, and perhaps, in the export of fresh fruit. A beginning has been made with the institution of factories, and the industry promises good commercial results.

There is no limit to the possible production of bananas in East Africa, and great results may be expected from this fruit as soon as means have been adopted for converting it into marketable form otherwise than in perishable condition.

At a meeting of the Legislative Council, Jamaica, March 19, 1920, Mr. Cousins, the Director of Agriculture, stated that the Governor had authorized a special expenditure for the construction of an apparatus for the manufacture of pimento oil at the Government Laboratory, whereby the essentials for the success of this new industry could be established before commercial activity is commended. Steps had been taken with a view to placing two contracts, each for 12 tons of pimento oil, guaranteed to contain 80 per cent. eugenol, at a price of 10*s*. per lb. By the end of April fairly large samples of pimento oil would be available from the experiment plant at the Laboratory, and these would be sent to the manufacturers of vanillin abroad, to be tested in competition with clove oil. (The *Jamaica Gleaner*, March 20, 1920.)

EDUCATION AND RESEARCH CHIEFLY IN RELATION TO SUGAR AND RICE.

NOTES ON A VISIT TO HAVANA AND NEW ORLEANS.

The following information was obtained by Mr. W. R. Dunlop, Scientific Assistant on the Staff of the Imperial Department of Agriculture, during a visit to Havana and New Orleans while proceeding to British Honduras on special duty at the commencement of the present year.

This information should prove of value in connexion with the projected agricultural college scheme for the British West Indies.

At Havana Mr. Dunlop had the opportunity of meeting the Secretary of Agriculture, Commerce and Labour; and others of the Staff of that Department, and also other gentlemen connected with Cuban agriculture. Through the courtesy extended by these, it was possible to gain a fair insight into the education and research facilities at present existing in the Republic.

The Cuban Government spends over $4,000,000 per annum on agricultural administration, education and research. The equipment of the experiment station, the University laboratories, and the agricultural schools is elaborate and up-to-date. In time these institutions may be expected to play an important part in the improvement and development of Cuban agriculture; but at present one gets the impression —rightly or wrongly—that the work of these institutions is handicapped by a somewhat excessive infusion of politics, which means that continuity of effort and of purpose is not preserved, as it should be, and, in consequence, real progress is to some extent retarded. The general administration of agricultural affairs in Cuba is vested in the Secretary of Agriculture, Commerce and Labour. This officer is supported by a sub-Secretary and a Director of Agriculture, all of whom have their offices at the Government Buildings in Havana. The Central Experiment Station is situated at Santiago de las Vegas, about 20 miles from Havana. The work of this station is arranged in a general way by the Director of Agriculture, and the routine and discipline are maintained under the supervision of an Administrator. This experiment station possesses splendid laboratories, where a chemist, a mycologist, and entomologist carry out their investigations. The adjacent experimental grounds cover a considerable acreage, and the visitor is impressed with the variety of different crops that are being investigated. These include sub-tropical as well as tropical plants, and even northern crops like wheat occupy a place in these experiments. A large amount of sugar seedling work is being done. The collection of citrus plants at this station is very fine indeed. Equally interesting are the fodder crops. Cuba is a splendid country for live stock. At the experiment station are to be seen fine specimens of pure-bred stock. These include a Zebu, a Holstein, and a Hereford bull. The pigs are especially noteworthy for their excellence, and include pure-bred Berkshire, Tamworth, and other boars.

While the investigation of plant pests and diseases is carried on principally by the central experiment station, the work of plant quarantine and sanitation is carried out by the office of Plant Sanitation, under Professor Johnston, located in Havana. Attached to this office are several inspectors, and the office itself has a large clerical staff. Previous to Mr. Dunlop's visit last January, the office of Plant Sanitation had been actively engaged in fighting the so-called 'black fly' of citrus. But in spite of a most vigorous and highly organized campaign, it had not been found possible to get this pest under control. Under the able direction of Professor Johnston, however, the office of Plant Sanitation carries out highly valuable work and does a great deal to preserve the crops of Cuba in good health and condition

Agricultural education facilities in Cuba appear to be very much more advanced than anywhere else in the West Indies or Central America. The University of Cuba, beautifully situated on the outskirts of Havana, possesses a School of Agricultural Science, or what is better described as a school of agricultural engineers and sugar experts; for almost every student of agricultural science in Cuba aims at becoming an 'agricultural engineer'. This is quite understandable when one considers the immensity of the Cuban sugar industry, and the large number and size of the central factories in operation there. At the same time the University, with its finely equipped biological and chemical laboratories, its lecture rooms and work shops, offers every facility for the study of agricultural science in a general way. Agriculture, however, does not appeal to the Cubans, at least the academic student classes, and the splendid facilities for study and research are not taken advantage of as they should be. Mr. Dunlop points out that a gay and modern city like Havana is not the most desirable location for a School of Agriculture. A School of Agriculture, whether of University or of secondary grade, should be located in a centre of agricultural production—if possible in a centre where production is of a varied character. This tends to create the proper mental atmosphere, and it compels the students to come into personal contact with real problems of production and distribution. In spite of the fact that the Cuban University at present turns out only specialized agricultural engineers and sugar experts, the University does not possess a Sugar School. Sugar factory work has to be studied in the central factories of the Provinces, or else at the Audubon Park School, New Orleans, which will be referred to in some detail later on.

Another class of school in Cuba is the so-called provincial agricultural school for training men of the artizan type. Mr. Dunlop had the opportunity of visiting the Cienaga school, which is the one serving the province of Havana. It is a most commendable establishment as regards equipment, and is capable of serving the requirements of a much higher class of student than it is primarily intended for. It is really a small agricultural college. The students are provided with board and residence; there is a lecture room, a museum, and a chemical laboratory. But it is the model machinery that appeals most to the interested visitor. There is a model rice mill, well erected in a building by itself; there is a motor tractor for the students' use, and a large variety of agricultural implements. The school also possesses high-grade live stock, housed in model buildings, and there is a large farm where the students can study practical agriculture But as far as one could discover, the school is not taken advantage of to the extent it should be. One drawback to agricultural education in Cuba is the low standard of general education among the poorer classes of people. Very few of the labouring classes can even read or write. This deplorable defect must be overcome before any satisfactory progress can be made in the direction of technical education.

(*To be Continued.*)

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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NOTES AND COMMENTS.

Contents of present issue.

The editorial refers to the present high prices of sugar throughout the world, and the cause thereof.

Under Insect Notes, on page 170, will be found an article on termites or white ants, and methods of preventing their damage.

The conclusion of the article describing the variegation of leaves in certain tropical plants will be found on page 171.

An article on the electrification of sugar mills, as now being carried out in Cuba, will be found on page 164.

A new constructional material, known as asbestos cement, is described on page 163.

In Support of the Tropical Agricultural College.

At a meeting of the St. Kitts Agricultural and Commercial Society, held on April 24, 1920, there were present besides the members of the Society, His Honour the Administrator, Major J. A. Burdon, C.M.G.; and Sir Francis Watts, K.C.M.G., Imperial Commissioner of Agriculture for the West Indies.

Sir Francis Watts addressed the Society, confining his remarks to three points. The first was a warning about the possible introduction of the 'mosaic' or 'yellow stripe' disease of sugar-cane from other islands where it existed. It had been reported from as near as St. Croix.

The next subject was a very important one, namely the Report of the Empire Committee on Cotton. The chief feature in this report which concerned the West Indies was that in its first part it dealt with the Sea Island cotton produced in these islands. This Committee had been appointed to suggest means whereby the supply of cotton produced in the Empire could be increased. The present high prices would result in larger areas planted all over the world, and cotton planters in the West Indies must not sit down contentedly and think they had done everything possible, but should use every effort to increase the yield per acre. This could be done by the employment of scientific help, and in this connexion the work of the Experiment Stations had been of great value.

The last subject dealt with by Sir Francis was the establishment of a Tropical Agricultural College in the West Indies. He briefly reviewed the report of the Committee appointed to consider the subject, which has already been dealt with in these columns, and referred to the support, financial and otherwise, that had been promised by several of the West Indian colonies.

At the conclusion of Sir Francis's speech, the following resolution was proposed by Mr. J. R. Yearwood, and seconded by Mr. R. N. Smith:—

'That in the opinion of this meeting of the Agricultural and Commercial Society of St. Kitts, this Presidency should contribute a sum not exceeding £5,000 towards the establishment of a Tropical Agricultural College in the West Indies.

The resolution was carried unanimously.

Dominica Lime Trade.

Mr. Joseph Jones, Curator of the Botanic Gardens, Dominica, writes to say that a matter of considerable interest to the lime trade in that island is the expected arrival of the steamer 'Lake Fife', of the Windward Islands Line, which will call for a consignment of about 1,300 barrels of green limes, and sail direct to Mobile. If the steamers of this line can be induced to call regularly at Dominica during the summer months, it would undoubtedly lead to a considerable development in the trade of fresh limes, of raw lime juice, and

possibly other commodities. Such Dominica limes as have reached the Southern States in the past—and a considerable proportion did so in pre-war days—had to go by way of New York, and in addition to the cost of freight by sea, incured high charges for transport over 1,000 miles of railway.

Mobile in Alabama is a centre serving a large area with a large population; it is evident, therefore, if direct and regular communication by sea is established from the West Indies with that port, that a considerable demand may be created for fresh limes.

A word of warning may not be out of place. It is hoped that nothing will be left undone by shippers in the way of picking, selecting, and packing the fruit, in order that new clients may be impressed with the value and good keeping qualities of the limes from Dominica, and, it may be added, from other West Indian islands also.

Lectures on Agriculture in St. Lucia.

During the month of April a course of lectures on the science and art of agriculture was delivered to the head teachers of the primary schools of the island by Mr. A. J. Brooks, Agricultural Superintendent.

The subjects dealt with were, Plant Structures and Plant Food; the Atmosphere; and Soils and Manures, to which special attention was devoted.

Practical demonstrations were made as far as possible in the school-room where the lectures were delivered, and with such materials as are available to the ordinary school teacher.

It would seem that in this manner primary school teachers may be helped to make their instruction in agriculture more real and vital.

Close Season for Cotton in Antigua.

As was noticed in the *Agricultural News*, February 21, 1920, the island of Antigua for the purpose of close seasons for cotton was divided into two districts, in one of which the season was fixed from April 15 to May 15. This closure was successfully carried out, reports Mr. A. E Collens, Acting Superintendent of Agriculture for the Leeward Islands. As a temporary measure, the non-commissioned officers at the different police stations were appointed inspectors, and the work appears to have been done satisfactorly; all standing cotton, especially of the native indigenous type, has been thoroughly destroyed. There was, Mr. Collens states, some little grumbling on the part of the peasants about the destruction of the native cotton, as they declare it was useful medicinally. However, they appear to have realized that the measure is for their own interest, and have willingly complied with the regulations.

In view of the success of the enforcement of this first close season, the Committee of the Antigua Cotton Growers' Association has petitioned the Government that a similar date should now be fixed as the close season for 1921, thus giving due notice to cotton planters. It has also been recommended that the close season for the other district of Antigua should be fixed from July 1 to July 31.

Exhibition of Minor Industries in St. Vincent.

A Committee has been formed in St. Vincent under the patronage of His Honour the Administrator, for the purpose of holding an exhibition on June 30, of minor industries and minor products of the island.

From the prize list it appears that this is entirely an industrial, and not an agricultural exhibition in any sense. Such an exhibition as is proposed appears likely to serve a useful purpose by demonstrating in a practical manner, both to residents and to visitors, what the island is capable of producing as finished articles.

Sir Francis Watts, K.C.M.G., Imperial Commissioner of Agriculture for the West Indies, has been pleased to accede to the request of the Committee to hold the proposed exhibition under the auspices of the Imperial Department of Agriculture. If possible, Sir Francis hopes to be present at the opening of this exhibition.

New Sources of Camphor.

On another page of this issue there will be found an article on the possibilities of camphor production within the Empire by the cultivation of the camphor tree (*Cinnamomum Camphora*).

A note in the *Perfumery and Essential Oil Record*, April 20, 1920, draws attention to the development of other sources, and states that refined camphor in slabs, produced in Spain from rosemary and other oils, has recently been offered for sale in London.

This note also draws attention to the interest taken the subject of camphor culture by the United States Bureau of Plant Industry, Department of Agriculture

It appears that in Califorina the black sage (*Ramona stachyoides*), and the wild sages (*Artemisia frigida* and *A. trifoliata*) have been found useful as sources of camphor, which is also present in the oils from other species of Artemisia. The black sage, when in full flower, is said to yield about 0·75 of essential oil containing over 40 per cent. of camphor.

The oil from the California laurel or swamp bay (*Persea pubescens*) is also stated to contain over 20 per cent. of camphor, and it is supposed that it might be further developed as a source of natural camphor.

INSECT NOTES.

TERMITES, AND THEIR CONTROL.

Termites, usually known in the West Indies as white ants or wood ants, belong to the insect order Platyptera, and are not really ants at all, but get their common name probably from the similarity of their social organization to those of the true ants belonging to the order Hymenoptera. The termites, however, in their structure and life-history more nearly resemble such insects as the pond flies. They live in large colonies, generally with an extensive central nest containing one or more fertile egg-laying queens, and enormous numbers of workers. These queens attain a much larger size than any class of the workers.

Termites are nearly al ways blind, and hide away from the light. They build tunnels or covered galleries through which they travel across exposed surfaces from place to place. They feed upon wood, and cause much damage to buildings and furniture in tropical countries.

Because of their subterranean habits and insidious methods of attack, termites are very difficult to control or destroy. In 'Insect Pests of the Lesser Antilles,' Mr. H. A. Ballou, Entomologist on the Staff of the Imperial Department of Agriculture, recommends a mixture of arsenic and sugar, or strychnine and sugar, to be placed in the tunnels when discovered, as a poison bait. The insects which are killed by this, are eaten by other insects in the nests, and the poison becomes widely distributed. Where the nests themselves can be discovered, they may be broken down and removed. Poultry of all kinds are exceedingly fond of these insects, and will eagerly eat them, if the nests are broken up so that the insects are exposed.

Fig. 6. White Ant, or Wood Ant.

(*a*) *queen ;* (*b*) *nymph of winged female ;* (*c*) *worker ;* (*d*) *soldier. All much enlarged.* (From U. S. Dept. of Agriculture.)

A paper in the *Philippine Journal of Science*, October 1919, by Masamitsu Oshima, of the Institute of Science, Government of Formosa, deals with the question of preventing the damage done by certain species of termites in that island.

It has been well said that there is nothing safe from the jaws and destructive secretions of termites, except iron and stone. Such being the case, the extermination of these insects is almost impossible, and even preventive measures against their damage are difficult of application

The termites are classed in several genera, belonging to which it appears that there are fourteen species occurring in Formosa and Japan, four of which are destructive to wooden structures. Neither of these species occur in the West Indies, although one of them, *Leucotermes flaviceps*, belongs to the same genus as *L. tenuis*, which occurs in Barbados.

At certain periods the adult male and female termites, which are winged, emerge in swarms from the nest and fly a short distance from it, then falling to the ground. As soon as they reach the ground they cast off their wings. Then the male is attracted to the female, and the swarms separate into pairs, and enter into hiding p'aces in order to establish new colonies, usually under pieces of decaying wood, in holes and crevices in wood, or directly in the earth. During the first stage of the formation of a new colony both the male and female are active. They forage for themselves, and are equally important in rearing the first brood of young.

In infesting buildings these insects generally gain entrance from outdoor colonies. By means of subterranean tunnels or covered galleries of considerable length they reach the foundation of a building. Having attacked foundation timbers or supports in contact with the ground, they gradually extend their excavations through the building.

The author of the paper referred to above advises that the first step to destroy the pest, where it is widely distributed, is to disinfect the ground under a building by sprinkling over the whole surface of the site with heavy oil of petroleum or creosote oil.

Another precaution advised is to have a layer of cement concrete, about 6 inches thick, spread over the whole area of the site at ground level, the edges being extended about 3 feet beyond the external walls of the building. If this concrete layer be kept in a sound condition, without cracks or joints, the intrusion of termites from the ground is satisfactorily prevented. Nevertheless, it is possible that buildings may become infested by termites in spite of the existence beneath them of a perfect concrete layer. This is owing to the fact stated above that a pair of winged insects are capable of starting a new colony; thus the concrete layer on the ground may be strong enough to prevent pests entering from beneath, but does not forbid the intrusion of winged couples. Mr. Oshima has therefore made an investigation as to whether timber may not be so treated as to provide immunity from termite attack. Starting from the fact that certain species of wood are said to be naturally highly resistant to the termite, among which are teak (*Tectona grandis*), greenheart (*Nectandra Rodeaei*), and mahogany. (*Swietenia Mahagoni*), he discovered that such timbers owed their resistance to chemical rather than to physical properties, that is to say, that the immunity or resistance of such wood to termite attack is not effected by hardness or weight, but by the

presence in the wood of a chemical substance distasteful to the termites.

It was found in the first place, that what is known as camphor green oil, which a residual product obtained from the distillation of camphor, was an exceedingly efficient substance for employment in the treatment of timber for this purpose, the amount of oil that is effective in preventing damage varying with different kinds of timber. The camphor green oil is satisfactorily diluted for treating timber with a crude petroleum oil.

Other chemicals were experimented with for the same purpose, and it was found that those which consisted mainly of anthracene oil, a product of destructive distillation of coal tar, were effective in preventing the damage of termites. Anthracene oil, however, has an unpleaeant odcur, and is dirty and viscous.

SOME TROPICAL VARIEGATED-LEAVED PLANTS.

(*Concluded.*)

These notes, admittedly brief, may serve to indicate the direction along which research is proceeding, with the object of obtaining knowledge concerning the nature of segregation of characters in vegetative parts of variegated plants, as well as in gameto-genesis.

The following plants are those referred to in the earlier part of this article,

Bougainvillaea sanderiana var. The green-leaved type is a common garden plant. This variegated variety of it possesses leaves with broad and narrow creamy white areas bordering green. The variegation is very irregularly distributed, but with a marginal tendency. It is white-skinned in form. As Bougainvillaeas can be grown from root cuttings, it would be of interest to note the characters of plants produced by roots of this variety. Fully green plants would be expected for the reason previously described.

Pedilanthus tithymaloides var. The flat-leaved variegated variety of the indigenous species is grown in many gardens, but the variety in hot houses in England has leaves with white edges, which are curiously buckled up so as to give each leaf a boat-shaped appearance. The stems also are contorted. The variegation is mixed in character, or a coarse mosaic. In some leaves there may be white-skinned patches covering green, and in others only solid white and solid green.

Cyperus alternifolius var. This variety of the tall growing sedge, which is commonly known as the 'Umbrella Palm,' has leaves with broad and narrow white lines which extend to the stem. As the species thrives well along river banks and in moist situations generally, this variegat ed form should grow satisfactorily under similar conditions.

Vanilla planifolia, var : The variegation in the leaves of this interesting orchid is of the white-skinned form. The white areas are chiefly marginal, but vary considerably in size, and are irregularly distributed ; they frequently extend to the climbing stems also.

Pleomale (*Dracaena*) *deremensis*, var. *Warneckii*. In this plant the leaves are distinguished by unusual green and white areas. The margins of each leaf are banded with solid green tissue, inside of which are narrow solid white lines. The centre of the leaf is white-skinned over green. The definite grouping arrangement of the distinct areas is a striking feature.

Sansevieria trifasciata (*guineensis*), var *Lauretti*. The species is widely distributed and commonly cultivated. It is popularly known as the 'Snake-plant' on account of the horizontally arranged lightgreen markings on the leaves. The variety *Lauretti* is a distinct form with greenish-yellow leaf margins. The bands of yellow are about $\frac{1}{4}$-inch wide, and extend from the base to the tip of each leaf. It is not yet known whether buds can be formed in the yellow marginal areas, as leaves planted without 'eyes' have produced only plants which were not variegated. The buds of these were formed at the base of the leaf, but not in the yellow-banded tissue.

Hoya carnosa var. Among the varieties of Hoya there is one with white, but chiefly marginal variegation of the leaves. The white areas vary considerably in size and distribution. The green part on the upper side of the leaf has a white skin, but the lower surface is almost white, due to layers of white cells obscuring the green.

Aechmea lineata var : This bromeliad or 'Wild Pine' has long white-skinned leaves which are lined with numerous narrow greenish stripes throughout their length and breadth A well-known representative of the same natural order is the variegated-leaved pine-apple (*Ananas sativa* var).

Ficus radicans var. The green-leaved species is similar in habit to the 'West Indian Ivy' (*Ficus repens*). This variety of *F. radicans* is white-skinned.

The margins of the leaves are broadly and very unevenly edged with white tissue. The centres are green.

Yucca aloifolia var. This is a variety of the common garden Yucca. It has leaves with narrow white-banded edges bordering greyish areas. The centres are green. This description applies to the upper surfaces. The lower sides have the narrow white margins only with green inside. The variegation is of the white-skinned type.

Nerium Oleander var. Oleanders with wholly green leaves and flowers of different colours thrive in the tropics. The variegated variety here described has leaves which are coloured green and pale yellow. The pale yellow areas are both wide and narrow and very irregularly distributed, although chiefly marginal. In a leaf they may occasionally extend to the midrib along the whole of one side or a section of it. The epidermis is white. On the upper side of the leaf the green is not obscured by the white cells, but on the lower side it is almost hidden throughout by layers of them.

JIPPI-JAPPA HATS

As has been noticed before in previous issues of the *Agricultural News*, what are known as Jippi-Jappa hats are manufactured from straw obtained from the leaves of *Carludovica palmata*. For some time this industry has been conducted in Jamaica. Interest in it is also being taken now in Grenada, where the plant, having been introduced, appears to thrive.

The following note on this subject from the Secretary of the *Jamaica Agricultural Society* will probably be of interest. He states that : 'the Agricultural Instructor for the district where these hats are made, reports that it requires from eight to ten "heads" of the cured straw to make a coarse hat, and not less than twelve "heads" to make a medium fine hat; that the straw must be the very longest procurable and of fine texture to allow of fine hats being made; that an average person can make one coarse hat per day, valued at from 1*s*. 6*d*. to 2*s*.; in three days a worker can make a hat valued at from 8*s*. to 10*s*.; but it takes two weeks to make a hat valued at 30*s*., such as would be equal to a fine "Panama."'

GLEANINGS.

The Times, May 3, 1920, states that Sir George Foster Acting Prime Minister of the Dominion, has announced that the trade conference between Canada and the British West Indies will be opened at Ottawa on May 31. The object of the conference is the improvement of shipping facilities, and the extension of the existing preferential tariff agreement.

The Jamaica Legislature has authorized the Government to communicate direct with the Commonwealth Government of Australia on the subject of making Kingston a port of call for vessels of the Commonwealth line en route between Australia and the United Kingdom viâ the Panama canal. (*The Times* Trade Supplement, April 24, 1920.)

An interesting feature of Cuba's sugar exports in the last three years has been the phenomenal increase of that exported direct to Canada. In 1917 Canada took 3,515 tons; in 1918, 12,000 tons; and in 1919 the statistics show that Cuba exported 81,996 tons direct to Canada. (*Weekly Bulletin*, Department of Trade and Commerce, Canada, April 19, 1920.)

Few persons have any definite idea, says the *Queensland Agricultural Journal*, March 1920, what an inch of rain means. An acre contains 6,272,640 square inches. One inch deep of water on this acre will be the same number of cubic inches of water, which, at 231 to the gallon, is equal to 27,154 gallons. This immense quantity of water will weigh 228,190 lb or 114 tons. One-hundredth of an inch is equal to one ton of water to the acre.

The *Australian Sugar Journal*, March 12, 1920, in referring to the shortage of liquid fuel, suggests that it would be a profitable thing to grow cassava for alcohol production. It is said that a distillery could afford to pay £2 a ton for the tubers, and that the usual crop in Queensland is from 12 to 15 tons to the acre. Although some twenty years ago a splendid growth of cassava was obtained at the Mackay Experiment Station, the want of a market led to the abandonment of this crop.

A home-made rain gauge can be made of any staight-sided tin, the open end being carefully cut in order that the aperture may be of the same shape and dimensions as the bottom of the tin, and the sides remaining unbulged. This should be set in a clear spot on a flat surface. To ascertain the amount of rain that has fallen, it is only necessary to use the ordinary rule. An eighth of an inch represents about twelve and a half parts; a quarter of an inch 25 parts, and so on. This is not strictly accurate, but sufficiently so for ordinary purposes. (The *Agricultural Gazette of New South Wales*, March, 1920.)

The Union of South Africa now has some 34,000,000 sheep within its borders reared for both wool and mutton. There are over 8,000,000 head of cattle in South Africa excluding Rhodesia, and beef, the export of which was practically unknown ten years ago, is now sent to Europe at the rate of something like 21,000 tons per annum. Meat canning factories, planned in 1913, are now being erected in the Union and Rhodesia. To-day one can buy tinned tongues and meat, turned out by establishments in Rhodesia, and their overseas trade is in a vigorous and healthy condition. (*Production*, April 1920.)

At a recent meeting of the Hawaiian Sugar Planter's Association the manager of the Olaa Sugar Co, Ltd. reported that his paper-making plant is now turning out a material of excellent quality for the purpose of mulching, and in quantity to meet requirements. Up to date 810·8 tons of this asphalt-saturated paper have been applied to the fields, and 1,150 acres have been treated by the mulching process. Working twelve hours per day the plant is capable of supplying sufficient for 3,000 acres per year. (The *International Sugar Journal*, April 1920.)

A note in *United Empire*, April 1920, states that in Western Australia rabbits are no longer regarded as pests, but, on the contrary, they have become an important asset, both the carcases and the skins having acquired increased value for export. In consequence the authorities have found it necessary to draw public attention to the uneconomic character of the old methods of poisoning wild rabbits, and otherwise destroying them. Some time ago shipments of 500,000 lb. of rabbit skins from Australia, and 50,000 lb. from New Zealand realized an average of 7*s*. 9*d*. per lb. in the United States. An increase in demand for both carcases and skins is also reported from England.

As a development of the prohibition law in the United States, the authorities made up their mind that bay rum and toilet waters made with alcohol must be denatured by the addition of some modifying substance that would render these articles unpotable. The Bureau of Internal Revenue suggested the addition of $\frac{1}{4}$ grain of tartar emetic per fluid ounce. The toxic character of tartar emetic, and its effect when applied externally of causing irritation and pustular eruptions, are sufficient reasons againgst its use as a denaturing agent of toilet waters. It is suggested that among vegetable products, possibly useful as denaturants, colocynth would give satisfactory results in the proportion of 2 grains to the fluid ounce. (The *Perfumery and Essential Oil Record*, April 20, 1920.)

SOME POISONOUS PLANTS OF THE WEST INDIES.

As is well known, there are many plants growing in the tropics which are very poisonous either in their fruit, or in their foliage. For this reason it is well for visitors to refrain from tasting the fruit or leaves of unfamiliar plants. Some notes on the poisonous plants of Hawaii have lately appeared in the *Hawaiian Forester and Agriculturist*, March 1920. These describing plants found in the West Indian islands also are reproduced below.

FIRE WEED, OR THORN APPLE (*Datura Stramonium* and *D. Metel*).

A rank-scented, tall, narcotic herb with spiny ovoid-pointed capsules and tubular-funnel, shaped whitish flowers. The seeds of the plant are exceedingly poisonous, and prove invariably fatal when eaten. The alkaloids are atropine and hyoscyamine, the active principle of belladonna. Persons have been poisoned by sucking the flowers or eating the seeds. The symptoms are nausea, dry burning skin, dilated pupil, loss of sight, mania, convulsions, and death. Vomiting is not a common symptom. The thorn apple occurs in waste places and makes its appearance usually after or during the rainy season. Mention may also be made of *Datura suaveolens* and *Datura arborea*; both species are known sometimes as Angel's Trumpet and are cultivated in gardens in the West Indies. The large, white, pendent flowers make them conspicuous; and both species are poisonous.

THE CASTOR OIL PLANT (*Ricinus communisr*).

The well-known castor oil plant is very common in the West Indies especially in waste places. The seeds furnish the castor oil, a mild and safe purgative when refined. They contain 50 per cent. of oil together with an acrid poisonous substance, and three seeds have been known to cause death in man. The seeds are ten times more purgative than the oil. Recently, in Honolulu, a soldier died a few days after having eaten six seeds of this plant. The oil is not poisonous, but the pulp contains an acrid albuminous substance, called *ricin*. The seeds have also caused death in horses.

POINSETTIA (*Euphorbia pulcherima*).

The Poinsettia is also very poisonous, especially the latex or juice, and gardeners have often been severely poisoned while cutting the plants and handling them. A child is said to have died at Kauai, due to poisoning caused by sucking freshly cut stems of the Poinsettia.

GOOD LUCK BEAN (*Thevetia neriifolia*).

This small tree is sometimes planted near dwellings, and resembles somewhat the oleander on account of the narrow leaves. The flowers are funnel-shaped. yellow, and fragrant, the odour reminding one of tuberoses The fruits are somewhat triangular and black when ripe. It is exceedingly poisonous, as it contains a powerful heart-poison, known as thevetin, and also as theveresin. The milky juice is highly poisonous; the bark acts also as an acrid purgative and emetic.

OLEANDER (*Nerium Oleander*).

The oleander contains poisonous properties in all its parts; the odour of its flowers is also poisonous. It is a heart stimulant, and acts like *Digitalis*. Stock and horses have been poisoned by eating the leaves; the amount necessary to cause death in horses ranges from 15 to 20 grammes of green leaves, but more of dry leaves. In cows even a less amount is sufficient to cause death. The symptoms are a powerful heart stimulation which causes profuse perspiration, soreness of mouth and throat; the bowels act often, and death ensues usually in about twenty-four hours.

AGRICULTURE IN BARBADOS.

The first week of May, with the exception of one day was totally dry, but on the night of May 8, the spell was broken by a refreshing shower. Since then, on every day up to the time of writing, there have been some very welcome showers, which have been pretty general throughout the island.

This month so far, only about ½-inch has been registered throughout the island; apparently in the valley of St. George the most rain has fallen. The atmosphere is now cooler, and there is every indication that seasonable weather is near at hand. In the red soils the B. H. (10) 12 plant canes have resisted the drought better than any other seedlings. The same can be said of the ratoons of this variety; but, on the whole, the young plant canes in the black soil look better that any in the red soils where many fields have developed a great uumber of yellow blades.

Throughout the island, with the exception of a couple of plantations in St. Andrew, the old canes are drying, and should be reaped as quickly as possible.

The juice obtained now is perfectly sweet, some showing a density of 12 per cent. The ratoons however are getting dry, and give very little juice.

Some estates in St. Philip and Christ Church will be finishing their crops this week. At one estate in Christ Church the average tonnage per acre has been 29 tons, which is very good, considering the trying weather these estates passed through last year.

The crops have been a great deal shorter than was estimated. One factory can only turn out this year a little over half of the amount it made last year. On the whole, the average output will be about two-thirds of what it was last year.

Very little nitrate of soda or sulphate of ammonia has been applied to the ratoons as yet, on account of the dry weather which has been experienced; but, with the approaching rains, every effort will be made to apply them.

Every year at this time it is usual to see nice fields of corn, potatoes, and yams, but the weather has kept back the tillage for them. With coming rains, no time will be lost in preparing yam fields. Here and there a few fields are being forked, so that, as soon as a good rain falls, the yam beds will be made, and the yams planted. It is not too late to plant yams, and, if a liberal amount of farmyard manure be applied to the fields, and the weather be good, the yam crop will still be a good one.

Ground provisions are becoming scarcer each week, and will be so for some time, as nothing could be planted during the last two months, and what even has been planted prior to this, has been hard hit by the dry weather. (The Barbados *Agricultural Reporter*, May 15, 1920.)

THE VANILLA PLANTS OF TAHITI AND MOOREA.

The following review has been contributed to this Journal by Mr. John R. Johnston, Plant Pathologist on the Staff of the Agricultural Department, Cuba.

'Les Vanillieres de Tahiti and Moorea' is the subject of a 44 page report by Dr. E. P. Meinecke, published for the Chamber of Agriculture of the French Pacific islands of Tahiti and Moorea in 1916.

In the introduction is is noted that at least twenty-five fungus parasites have been reported on vanilla, many of these occurring in Tahiti and Moorea. The plantations of these islands were reported to be in a wretched condition as shown in the following. In 80 per cent. of the fields, the plants were weakened by the over production of the pods. In 90 per cent., plants were derived from exhausted vines. Seventy per cent. of the plantings were more or less ruined by chickens, pigs, and horses. Eighty per cent. of the plantations suffered from too much sun or too much shade. In 90 per cent. of the plants were wounds caused by the labourers. In 60 per cent. the protection from sun was neglected.

Vanilla plants grown under such conditions as outlined in this introduction would seem to be subjects proper for a horticulturist rather than for a phytopathologist, but Dr. Meinecke has treated the subject entirely in a practical way. In the first chapter he describes in detail the needs of the vanilla plant for the proper environment in order to avoid disease. In the second chapter he first treats of sun scald, degeneration of the plant, and injuries, or, in other words, such injuries as would not happen if the plants were grown under proper con ditions. There are no insect pests which seem to be serious, but included are an aspidiotus on the leaves, stem, and young fruits; a woolly plant louse (Fuceron lanigere) upon the vine and upon the petioles; ants; a microlepidopteron; a curculionid; and others of less importance. The parasitic diseases are then discussed: these include Cuscuta, common but not serious; anthracnose, the most serious of all, due to *Gloeosporium vanillae*, Massee., connected with other forms and given other names also; but these mycological questions are not settled. The anthracnose attacks leaves, stems, and fruit, but does not injure seriously vanilla grown under the most favourable conditions. The author, however, does not go into detail as to what conditions are most favourable for the fungus, nor as to resistant varieties. He mentions Fusarium as attacking the young growth, and speaks of bacteria as associated with the rot of the bark and leaves. He did not find *Uromyces Joffrini*, *Seuratia coffeicola*, and *Seuratia vanillae*, which hadbeen reported from Tahiti. The Capnodiaceae are mentioned.

In the third chapter, which is on the control of diseases, spraying is discussed, but the author appears to consider it impracticable.

In Chapter 4, on the culture of the vanilla, is described the amount of shade or sunlight desirable, the renewal of the plants, the selection and planting of the cuttings, nurseries, layering, distance of planting, care of the vines, and fertilizing of the flowers.

Doubtless the object of the report is attained in emphasizing the necessity of certain conditions for the growth of the plant; it is certain that this is of prime importance. It is, however, to be regretted that more accurate information was not obtained as to the specific pests and diseases which attack this plant.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. During the month of April plant and seed distribution was as follows: 1,300 coco-nuts (imported from Dominica), 400 onion plants, 14 ornamental plants, and 3 fruit trees. There was also free distribution under the Food Crops Compaign in all the parishes, of the following: yams, 14,409 lb; tannias, 3,242 lb; corn, 802 lb.; eddoes, 3,242 lb. In addition, 12 lb. of Robusta and Excelsa coffee were imported from Trinidad for seed purposes. About 20 seeds of camphor, received from the Imperial Commissioner of Agriculture, have germinated. Regarding staple crops, Mr. Williams the Superintendent of Agriculture states there are indications that approximately 100 acres of land will be planted in Marie Galante cotton this year. Local prices are 2*s*. 6*d*. to 2*s*. 8*d*. per lb. for ginned Marie Galante cotton. There is evidence of increased interest being taken in the planting of ground provisions, Red ring disease and scale insects are reported to be on the increase in coco-nut cultivation at Sauteurs. The rainfall registered at Richmond Hill during the month was 30 parts.

ST. VINCENT. Plant distribution during the month of April included 14 coco-nut plants, 160 cane plants, 89lb. cotton seed, and $\frac{1}{4}$lb.beans. Regarding staple crops, Mr. Jackson states that practically all Sea Island cotton in the island has been reaped. The reaping of Marie Galante continues, and good returns are being obtained. Large areas are in preparation for cotton planting, but some difficulty is being experienced, owing to shortage of labour. Vegetables are still fairly cheap and plentiful. The Cotton Ginnery received for ginning, 181,951 lb. of Sea Island, and 71,540 lb. of Marie Galante cotton. The quantity of cotton purchased was—Sea Island, white, 46,142 lb., stained 6,462 lb; Marie Galante, 65,032 lb.; 43,133 lb. of Marie Galante cotton was ginned. The work of eradicating host plants of the cotton stainer was continued during the month, 247 silk-cotton and 'John Bull' trees having been pruned or destroyed in the leeward part of the island, and twenty in the windward section. No rain fell at the Botanic Station during the month. At the Experiment Station 62 parts were recorded.

ST. LUCIA. Plants distributed from the Experimen; and Botanic Stations during the month of March included grafted mango plants, 2; nutmeg plants, 12; ornamental, 2. Small pickings of cacao are still coming in; the lime trees are flowering, and in regard to sugar, reaping operations continue. The rainfall as recorded at the Botanic Garden, Castries, for the month totalled 4·75 inches; at the Agricultural Station, Choiseul, the precipitation was 3·40 inches.

During the month of April plant distribution comprised the following: lime plants, 500; grafted mangoes, 5; ornamental plants, 8; vegetable seeds, 106 packets. As regards staple crops, the Agricultural Superintendent states in connexion with the sugar crop, that reaping operations are in full swing. The small peasants' mills are manufacturing syrup, which finds a ready sale at 12*s* per kerosene tin [5 wine gallons]. Lime trees are flowering well, and give promise of a good crop. Concentrated juice from the Government Lime Juice Factory was sold on a £45 basis. The condition of cacao is said to be normal. A series of lectures on the Science and Art of Agriculture was delivered by the Agricultural Superintendent to the Head Teachers of the Primary Schools, who assembled in

Castries for the purpose. The island is suffering from the effects of a prolonged drought, only 95 parts of rain having been registered at the Botanic Garden, Castries, during the month, and 29 parts at Choiseul

DOMINICA. The lime crop reaped from the Lime Experiment Station during April was 85½ barrels, of which 56 barrels were green limes. From the Cacao Experiment Station 10 bags of cacao were shipped to London. The local price for ripe limes, the Acting Curator states rose from 6*s*. 6*d* to 7*s*. 6*d*. per barrel, and for green limes from 16*s*. to 18*s*. per barrel. There is a good local demand for dried cacao at 8*d*. to 9*d*. per lb. The weather during the month was very dry, the rainfall recorded being only 22 parts. This, it is stated, is the lowest rainfall recorded for any month for twenty-seven years since records have been kept.

MONSTERRAT. Mr. W. Robson, Curator, writes to say that a period of unprecedented drought prevailed in April, no rain having fallen at any Station at any time during the month. Consequently, with the exception of routine work, operations in the Experiment Station were practically at a standstill. Plant distribution included 40 bay plants, 40 lb. ground nuts, 5 lb. white velvet beans, 6 packets various beans. Eight distillations of bay leaves were made, making a total of twenty eight for the year, with an average yield of 19·7 oz. of oil per 100 lb. of green leaves. A supply of 1,500 comphor seeds was received from Japan, Trinidad, and Florida, a few of which have germinated. The ratoon plot of cane varieties at Farrels was reaped, B.H. 10 (12) occupying the first place in tonnage. The total cotton crop for the 1919-20 season is found to be 548,334 lb. of lint. The figures so far obtained show that the area grown was 3,184 acres thus giving an average yield per acre of 172lb. of lint, which is the best return for the island since 1910-11. The percentage of stained cotton in the crop was 3·4, as compared with 5·8 per cent. in the previous year. Much time was occupied in determining the available fibre content in the strains of cotton in cultivation in the present season. This phase of the work would appear to be of considerable importance. Observations show that cotton stainers are still infesting two species of Sida, though in reduced numbers.

ANTIGUA. Plant distribution during April included 2 packets of bean seeds, and 3 decorative plants. As the result of continued dry weather, Mr. A Gallwey states, the matured cane crop which is being reaped is yielding light returns per acre. The young canes have also received a set back, and a considerable amount of supplying will have to be done when rain falls. The cotton and onion crops were brought to a close during the month. The purchasing of cotton from peasants, on behalf of the Antigua Cotton Growers' Association, ceased on April 15. During the half month 9,519 lb. seed-cotton were purchased, the total quantity purchased for the season being 24,718 lb. The Onion Drying House was closed on April 28, During the month 19,178 lb of onions were received, making a total delivery of 53,789 lb for the season. Four hundred and fifteen crates of onions were shipped during the month, making a total of 915 crates shipped to date. Mr. J. Sydney Dash, B.S.A., accompanied by Mr. A. E. Collens, Acting Superintendent of Agriculture, visited the Botanic and Experiment Stations on more than one occasion during the month. The work in connexion with soil grub investigations was continued, and a campaign against wood ants in the Botanic Station was commenced. A period of very dry and hot weather prevailed throughout the month; only 16 parts of rain fell at the Botanic Station, the total rainfall for the year to date being 7·08 inches.

ST. KITTS. Mr. Shepherd states that no agricultural work of any kind has been possible in the Experiment Station and Botanic Garden during the month, owing to the severe drought. The reaping of the sugar-cane crop is progressing rapidly both at the factory and on estates making syrup Returns are good in most cases, and the quality of the juice has improved. The young cane crop is having a hard time, but is so far standing the drought well. The late supplies cannot germinate, and when rain comes much replanting will have to be made in some fields. The early cotton, planted in February and March in the Northern district, is doing well, but premature flowering is setting in, and the plants will be small. Preparation for planting is in progress in Basseterre district The month of April creates a record, as no rain has at any time fallen at this Station. Meetings of the Agricultural Society were held on April 10, and 24. A Resolution in favour of the establishment of a Tropical Agricultural College in the West Indies was passed at the first meeting, and at the second, which was attended by the Imperial Commissioner of Agriculture and the Administrator, a Resolution was passed in favour of the local Government contributing a sum not exceeding £5,000 towards the establishment of such a college. The total rainfall for the year to date is 9·65 inches.

NEVIS. The Agricultural Instructor, Mr. W. I. Howell, states that, on account of the prevailing heat and dry weather during the month of April, very little beyond watering and farming has been done at the Experiment Station. The reaping of the cane crop is in progress, and the yields continue fair, but in some places the cane fields have practically dried down, and the young canes are suffering very much from want of rain. Preparation for cotton is almost complete, but no planting has been done on account of the dry weather. A meeting of the Agricultural and Commercial Society was held during the early part of the month, when the questions of a close season for cotton, and the destruction of the cotton stainer were discusssed. The rainfall record for the month was 2 parts; for the year to date the total precipitation has been 7·82 inches.

BRITISH VIRGIN ISLANDS. The Curator of the Experiment Station, Tortola, also reports a prevailing drought in April which brought all planting operations at the Station to a standstill. Much watering was necessary to keep the nursery plants alive. In spite of drought, however, onion seedlings and sets are making good growth. It is observed that the placing of a layer of megass over a nursery bed of cocoanuts greatly assisted germination Regarding the staple crops, the harvesting of cotton is said to be nearly over, and the clearing of new fields for planting is general throughout the Presidency; a considerable increase in acreage is anticipated. At the end of April the local price of seed-cotton had risen to 1*s*. 6½*d*. per lb. The crop to date amounts to 122 bales, and will exceed that of last season. The attacks of the cotton stainer (*Dysdercus andreae*), on the western portion and islands of the Presidency were accountable for the loss of some portion of the cotton crop in those districts. As a special line of work in crop experiments it is satisfactory to record the results of the onions crop planted at the Station in December and January. A total area of $\frac{7}{10}$ acre was planted; from this, 2 936 lb. of cured onions were sold for the sum of £53, being a calculated yield of 1·8 tons, valued at £75 approximately per acre. From this field also a couple of thousand of small onions were dried off as sets which are not taken into account in the above statement The rainfall recorded for the month was 36 parts.

MARKET REPORTS.

London.—The West India Committee Circular, April 15.

Balata—Venezuelan Block, no quotations ; West Indian Sheet ; spot, 4*s.* 8*d.*
Beeswax—No quotations.
Cacao—Trinidad, 144*s.* to 150*s.* Grenada, 124*s.* to 130*s.* St. Lucia, No quotations. Dominica, 120*s.* to 130*s.* Jamaica, 121*s.* 6*d.* to 137*s.* 6*d.*
Copra—£58
Honey—No quotations.
Lime Juice—Raw, 3*s.* 6*d.* ; Concentrated, no quotations.
Pimento—6*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T. S. Garraway & Co., April 28.

Arrowroot—$9·00 per 100 lb. duty paid.
Cacao—No recent sales.
Coco-nuts—$52·00 husked nuts.
Hay—Market bare.
Onions—Lottings at $17·79.
Peas, Split—No quotations; Canada, Market bare.
Potatoes—$8·00.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, April 20.

Bay Oil—27*s.* to 32*s.*
Lime Oil—7*s.* 9*d.* to 8*s.* for West Indian distilled, and 16*s.* to 25*s.* for hand-pressed.
Orange Oil—West Indian, 35*s.*

Trinidad.—Messrs Gordon, Grant & Co., May 5.

Cacao—Venezuelan, $25·70 to $26·00 ; Trinidad, $24·00. to $24·50.
Coco-nut Oil—$2·35 per gallon.
Coffee—Venezuelan, $5·50 per famga in bond.
Copra—10½c. per lb.
Dhal—No quotations
Onions—$15·00 per 100 lb. Light stocks.
Peas, Split—$10·00 per bag.
Potatoes—English, $8·00 per 100 lb.
Rice—Yellow, $13·00 to $13·50. White, $14·00 per bag.
Sugar—No quotations.

New York.—Messrs. Huth, Gillespie & Co., Inc. May 6.

Cacao—Caracas, 20c. to 20½c.; Grenada, 19c. to 19½c. ; Trinidad, 19¾c. to 20c. ; Jamaica, 15c. to 16c.
Coco-nuts—Jamaica selects, $53·00 per M; Trinidad $53·00 per M; culls, Jamaica, $35·00 ; Trinidad $35·00 per M.
Coffee—Jamaica, 18c. to 24c. per lb.
Ginger—38c. to 42c. per lb.
Goat Skins—Jamaica $1·40; Antiguaa nd Barbados, $1·30 St. Thomas and St. Kitts $1·30
Grape Fruit—Jamaica, $3·00 to $4·25.
Limes—No Market.
Mace—36c. to 38c.
Nutmegs—26½c.
Oranges—$3·50 to $4·50.
Pimento—8½c. to 8¾c. per lb.
Sugar—Centrifugals, 96°, 18¼c.; Muscovados, 89°, 15¾c.; Molasses. 89°. 15¾c.

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We can supply you with the above, selected from Seed grown at the Government Industrial Schools, and the Lunatic Asylum Farm, under the supervision of the Agricultural Department. Lint from this Seed has been highly reported on by the Spinners in England.

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May 15, 1920.

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St. Kitts: The Bible and Book Supply Agency, Basseterre.
Nevis: Mr. W. I. Howell, Experiment Station.
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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

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Trees as Protection against Wind and Erosion.

THE importance of conserving the forests still remaining on mountains or hills in these West india Islands, and of the reafforestation of areas denuded of trees, has been pointed out in several previous issues of this Journal. There is another line, however, of what may also be termed reafforestation, which appears worth while bringing to the notice of West Indian land-owners; and that is the more extensive planting of wind-breaks.

A wind-break may be defined as a belt or body of trees which gives protection to growing crops from prevalent or violent winds. This protection from air currents is effected by a timber wind-break in a purely mechanical way. Its effectiveness depends, therefore, upon the impenetrability of the wind-break. An ordinary row or two of trees does not present an absolute barrier to the wind; a certain amount of air finds its way between the branches and foliage of the trees, so that the movement of air on the leeward side is not completely stopped; it is only greatly reduced. Again as the trees grow older, openings are left between their trunks, and such wind-breaks can only be made efficient by underplanting with trees or shrubs of smaller growth. An ideal windbreak for checking wind currents would be one of central rows planted with tall trees, on either side rows of shorter trees, and outside of these still lower bushes. Such a wind-break would have an inclined surface, which would divert the air current upward, and thus relieve the horizontal wind pressure.

It is, of course, difficult to measure in terms of money the value of a wind-break in giving protection to such annual crops as sugar-cane or maize, or to such orchard, crops as limes; but it is stated in *Farmer's Bulletin 788*, of the United States Department of Agriculture, that where winds are at all frequent, such protection may be quite equal to the rental of the ground occupied by the trees. A case is quoted of a farm in Southern Minnesota, where a wind-break afforded complete protection for a strip about ten rods wide during a wind blowing about fifty miles an hour. On the unprotected part of the field the crop was so damaged as not to produce more than a third of what had been estimated. On the protected portion

a full crop was produced from six acres, whereas the wind-break occupied only two acres.

Another benefit derived from wind-breaks is the reduction of evaporation. Anything which helps to conserve the moisture of the soil, especially in dry districts, is of direct benefit to the planter. The bulletin quoted above states that a wind-break has this effect in a marked degree. The drying power of the wind is reduced very nearly in the same proportion as its velocity. In the immediate lee of effective wind-breaks evaporation is reduced as much as 65 per cent. Here in the West Indies, where the trade winds blow with considerable force throughout the growing season, especially at the earlier part of the growth of the cane crop, their drying power is well known to planters, and it would seem important to use means of preventing evaporation.

In an article contributed to the *International Sugar Jonrna*[illegible], March 1920, on the value of tree planting on sugar estates, Dr. C. A. Barber refers to his experience in the value of wind-breaks at the Experimental Sugar Station at Coimbatore in South India. He says that, provided there is plenty of overhead sunlight, the sugar-cane appears to be very grateful for lateral shade and protection. In the bulletin mentioned above it is stated that corn or maize crops showed more consistent and marked benefit from protection by wind-breaks than any other crops. Fields of young corn showed much better growth in the area protected, and this benefit was still in evidence at the end of the season, the protected area not only producing more fodder, but bigger and heavier ears. With ordinary food crops a benefit may be derived from wind-break protection which will make the loss of the area occupied by the trees negligible.

It must be remarked that the effect of a wind-break on crops is not beneficial in every respect. There are certain ways in which it is evidently injurious. Trees in a wind-break always spread their roots extensively into the adjoining fields in search of moisture; and they take not only the moisture, but some of the necessary plant food out of the soil. Furthermore, if allowed to spread their boughs too widely, by shading the ground they will prevent crops from developing properly. It would, therefore, be improper to plant trees where their roots interfere with the proper growth of canes or other crops. In this connexion it may he observed that the injurious effect of different species differs very greatly. Such trees as the 'Barbabos Evergreen' (*Ficus nitida*) and other allied species, or such trees as tamarinds, may be instanced as certainly injurious to crops in their neighbourhood, although Dr. Barber states that by digging trenches four feet deep, and clearing these once a year, it has been found possible to grow excellent cane crops right up to tamarind trees. The plan of digging a deep trench between the wind-break and the field in which a crop is planted, and the regular cleaning out of such a trench would seem to be the correct method of preventing possible loss from the tree roots, while obtaining the benefit of protection from the wind by the trees. On the other hand, there are many leguminous trees such as *Albizzia Lebbek* ('Women's tongues'), *Pithecolobium Saman* ('Jamaica Shade Tree'), and various species of cassia, and also such smaller leguminosae as *Gliricidia maculata*, which have probably a beneficial effect upon the soil.

In some of these islands, where Lebbek and Saman trees are grown for shade purposes in Guinea grass pastures, it has been remarked that the grass grows luxuriantly right up to the base of the trees.

Other classes of trees which, would probably be of great value in the formation of wind-breaks, are those which themselves produce a remuneartive leaf crop, such as camphor and pimento. The systematic pruning of these trees for the sake of their leaves and twigs would keep the wind-break under proper restraint, and also prove a source of profit to the planter.

Apart from the question of what material to use to construct a wind-break, there is another point to be considered, namely, the direction in which the wind-break should be laid out. In the West Indies the answer to this question is simple. Owing to the prevalence of the trade winds, roughly speaking from east to west, the line of a wind-break should be, also roughly speaking, north to south; thus the greatest amount of protection for the greater part of the year would be attained.

The foregoing applies strictly to the protection of crops from the wind. If, however, the term wind-break is used in a wider sense, as denoting a continuous belt of trees planted without reference exactly to the prevailing direction of wind there is another aspect of the beneficial effects capable of being produced. Such belts of trees are capable of largely preventing soil erosion on

exposed slopes. In such an island as St. Kitts where, between the forests that occupy the tops of the mountains and the cane cultivation on their lowest slopes, there is a fairly broad strip of comparatively exposed grass land, such an area is liable to be much eroded by heavy rainfalls which occur not unfrequently in these islands, and the damage is spread to the cultivated area below. If such slopes were planted with belts of trees at various levels, the damage done by such occasional heavy downpours of rain would certainly be lessened, the water would be largely held up by these belts, and let out gradually, while each belt of trees would help to retain the useful surface soil, and prevent it being carried by floods into the sea.

There is another point in favour of more general planting of belts of trees, and that is, that they are of value as a source of fuel supply. Wind-breaks, as was noted above, have to be kept within bounds as regards the spread of their branches. Consequently pruning and trimming ought to be regularly and consistently carried out. Such pruning would yield a considerable amount of wood available for sale as fuel. The prunings also would not only yield wood for fuel, but the leaves from the prunings or trimmings would form an exceedingly valuable mulch for the neighbouring fields.

In conclusion, the two main uses of belts of trees are first, to shelter crops from strong and drying winds; and secondly, to hold water on exposed slopes which, if unchecked, rushes down, sometimes with uncontrollable force, carrying with it to the sea a large amount of the valuable surface soil.

THE AUSTRALIAN RED CEDAR.

The West Indian or tropical American red cedar (*Cedrela odorata*), produces the fragrant wood from which cigar boxes are made. Another species of the same genus, *Cedrela australis*, is described by Mr. C. S. Judd, Superintendent of Forestry, Hawaii, in the *Hawaiian Forester and Agriculturist*, March 1920, as likely to be of considerable value for afforestation purposes. From his description, much of which is reproduced below, this tree would appear to be very probably suitable for similar purposes in these West Indian islands.

This cedar is a native of eastern Australia, and is found in scattered belts in the warmer localities of Queensland and New South Wales, where the annual rainfall is over 40 inches. There it does not form pure stands, but is found mixed with other trees in the high forest over a dense underwood.

The tree coppices freely and vigorously, and may be raised from cuttings without difficulty. It bears heavy crops of seed, usually every two years, and these seeds being very light and winged, are readily distributed by the wind. One pound of red cedar seed contains about 70,000 seeds. This feature makes the tree particularly suitable for areas in Hawaii, where it is desired to secure an extension of the forest by natural reproduction. The seed requires full sunshine for germination, and, being intolerant of shade, it will not grow under other trees. The power of the seed to germinate is not retained over a lengthy period, and the seed must therefore be sown soon after it is harvested.

The seeds, when fresh, have a very high percentage of germination, however, and the young seedlings exhibit very rapid growth, develop a strong root system, and are very amenable to nursery treatment.

In its native habitat the red cedar shows an average diameter growth of one inch per year over a very long period of years, and will attain a total height of 200 feet, a clear bole length of 100 feet, and a maximum diameter of over 10 feet.

The chief value of this red cedar is for its wood, which is very similar to mahogany but lighter. It is prized very highly in Australia for use in furniture and piano making, turnery, boat building, window blind frames, and general house construction. It seasons well, is durable, is immune from boring insects, and is susceptible of a high polish It is especially valued for the making of racing boat shells, on account of its light weight and great strength, and choice veneers are cut from the junction of the branches with the stem. The bark contains a considerable quantity of tannin, which produces a purplish leather.

The Australian red cedar, on account of its ease of propagation, rapid growth, and valuable wood products, gives great promise as one of the future timber-producing trees in the Territory of Hawaii. Fortunately, much progress has already been made towards its establishment in those islands.

In 1914 there were imported 200 of the trees from Australia, and these were planted at Kunia in Honouliuli, Oahu, in a region of very scanty rainfall. They have shown excellent growth in the comparatively arid region where the irregular rainfall averages only about 30 inches a year.

CLOSE SEASON FOR COTTON IN BARBADOS.

The Governor of Barbados, in Executive Committee, on the recommendation of the Director of Agriculture and in accordance with the Cotton Diseases Prevention Act, 1920, has published an Order dated June 10, 1920, that during the month of July 1920 it is unlawful for cotton to be planted or to be growing on any land in that island.

SUGAR INDUSTRY.

CANE EXPERIMENTS IN ST. CROIX.

The Imperial Commissioner of Agriculture for the West Indies has recently received from Mr. Eduard Gedde, a copy of his report, as Manager of the Slob Experiment Station, St. Croix, on experiments conducted there for the year 1919-20.

This report gives a description of experiments in the cultivation of the sugar-cane, which are of considerable interest and value. These experiments are conducted on an experiment station of an estate belonging to a private company. They are of a kind which might be undertaken on any plantation, and if results of such experiments were tabulated carefully, as Mr. Gedde has done, the accumulation of data obtained from different islands would naturally be instructive to cane planters. Experiments of this nature might also be carried on at Government Experiment Stations to considerable advantage.

One of the experiments recorded in the report under review was with regard to the best distance apart at which to plant the sugar-cane. The usual custom, it appears in St. Croix, is to plant the canes in trenches 4 feet 6 inches apart with a distance of 3 feet between the plants in the row. In some cases the custom obtains of planting at distances of 4 feet by 2 feet. Mr. Gedde is a great believer in the cultivation of sugar-cane on the flat rather than between banks, and the canes in this experiment were so planted. He argues also that it is reasonable to suppose that a cane plant would be more likely to develop healthily if it obtained equal light and air on all sides. He also considered that cultivation would be more easily effected if the canes were growing at equal distances in every direction. Accordingly an experiment was planned by him, comprising thirty plots of $\frac{1}{10}$ acre each. A series of six plots each was planted at the varying distances given in the table below, in which also the calculated yield of cane per acre is given in tons. All the plots had the same cultivation and manurial treatment; they were all planted at the end of October 1918, and harvested at the beginning of February 1920.

No. of plot.	Planting Distance.				
	5 ft. × 2 ft.	4ft. 6in × 3ft.	4 ft. × 2 ft.	3ft. 6in. × 3ft. 6 in.	3 ft. × 3 ft.
	Yield per acre in tons.	Yeild per acre in tons.	Yeild per acre in tons.	Yeid per acre in tons.	Yield per acre in tons.
1.	34·9	39·3	40 5	39·3	42·6
2.	38·3	38 3	38·3	40·6	45·1
3.	36·0	39·2	38·0	44 5	42·4
4.	34·1	41·7	39.6	40·0	41·8
5.	39.6	43·0	40 0	41·8	44·5
6.	41·1	41·5	42 7	40 5	45 6
Average.	37·3	39·6	40·5	41·5	43·7
Probable error.	± 1·88	± 2 23	± ·77	± 1 28	± 1·07
Per cent.	5·0	5·5	2·5	3 2	2·4

In considering the results given in the above table, it seems that they may be regarded as trustworthy seeing that in every case the probable, error when calculated on the number of plots does not exceed the very reasonable amount of 5 per cent. in some cases being much less.

The conclusion drawn by Mr. Gedde is, as is seen by the yield, that the best result is obtained when canes are planted at equal distances in both directions, as in fact he expected It will be seen that in both instances of 'square planting', as Mr. Gedde calls it, whether 3 feet 6 inches by 3 feet 6 inches, or 3 feet by 3 feet, a heavier yield was given than from what might be called 'oblong planting', as in the first three columns.

Another interesting and instructive experiment recorded by Mr. Gedde relates to the question as to what material used for cuttings would give the best results. In St. Croix, Mr. Gedde states, in most cases tops from second, third, and sometimes fourth ratoons are used for planting. In his opinion this practice does not seem to be sound, as he considers that healthier growth would be made by cuttings obtained from tops of plant canes first ratoons. Accordingly he planned an experiment consisting of twenty-four plots in three series of eight each, planted respectively with top cuttings from (1) plant canes, (2) first ratoons, (3) second ratoons.

On October 25, 1918, fifty tops were planted in each plot on the flat, all the plots having been similarly treated beforehand. The rainfall in the succeeding two months conduced to regular sprouting, and the canes grew well. The following table gives the calculated yields of cane per acre of the different plots, and the average return from each series.

As will be seen, the probable errors inthe results are well within the accepted limits, except in the case of the third series.

Calculated Yield per Acre in Tons.

No. of plot.	Cuttings from plant canes.	Cuttings for 1st ratoons.	Cuttings from 2nd. ratoons.
1.	45·0	50·4	43·5
2.	45·3	52·2	38·0
3.	40·6	45·3	30 8
4.	42·0	46·0	36 9
5.	42·0	47·5	32·3
6.	35·6	46·1	32·3
7.	42·0	38·8	31·5
8.	42·0	40·2	29·4
Average	41·8	45·8	34·3
Probable error.	± 2·0	± 2·15	± 3 17
Per cent.	4·8	4·70	9·25

The results of this experiment show that cuttings from first ratoons gave 4 tons more per acre than those from plant canes, and 11½ tons more than those from second ratoons. Mr. Gedde states that in every case the cuttings were most carefully selected, and only those free from insect or fungus attack were planted.

There are two directions in which the foregoing experiment appears to be especially instructive. It is often considered, in the selection of cane tops for planting, that the larger and juicier the top the better it is for this purpose, and that consequently cuttings from plant canes are the most desirable. On the other hand, there is sometimes a tendency to use as plant material what is of least value at the mill, such as second or other ratoons. In both these directions Mr. Gedde's experiment seems to afford a guide to good practice. The large yield obtained from planting material derived from first ratoons agrees with what might have been expected, as such cuttings would be likely to be, not only vigorous, but sufficiently hard to maintain their germinating power for a longer period than cuttings from plant canes, while, on the other hand, they would be likely to produce more vigorous growth than cuttings from later ratoon crops. From whatever crop of canes, however, cuttings are selected for planting purposes, a point to be emphasized is that the cuttings used should be absolutely free from infestation by insect pests or fungus diseases.

It is intended to refer to some other experiments made by Mr. Gedde in St. Croix in a future issue of this Journal.

The Canadian fruit growers, particularly those of British Columbia, have been objecting very seriously to export licences of sugar from the Dominion, because last year they had such a hard time getting sugar supplies for the fruits that they can. Sugar even now is scarce, and is selling at $16·50 and some places higher. The refiners however say that if they do not have export licences then the markets will be glutted. (The *Louisiana Planter* May 1, 1920.)

FLORIDA'S SUGAR OPPORTUNITY.

An interesting article which may find local parallels in the West Indies, appeared under the above heading in the *Louisiana Planter*, May 1, 1920, from which the following paragraphs are reproduced.

Florida had many small sugar-houses before the civil war. Some of them were said to be of considerable size, and altogether Florida was known as a possible sugar-producing State.

As the sugar-cane industry had only been carried on in a small way, and was a somewhat difficult, and constantly a progressing scientific agriculture and manufacture, general attention was not paid to it, but still there were vast areas of land available for cane cultivation.

With the old small outfits, of which hundreds, perhaps thousands, were in use in Florida, great quantities of cane syrup were produced without completing the process and carrying it on into crystalline sugar. This syrup industry of Florida is an immense and a very legitimate industry there at the present time.

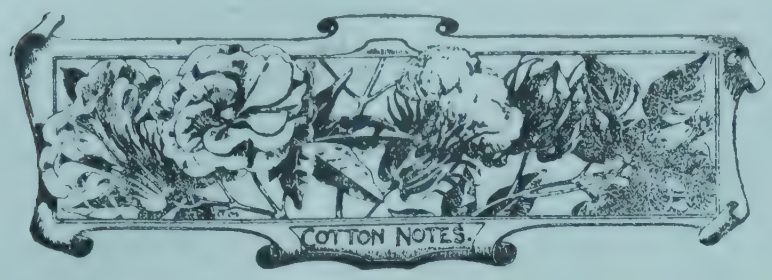
In addition, however, to this prosperous syrup industry, there has arisen a new interest in actual cane-sugar production on a large scale. The basis of this would seem to be now more climatic than otherwise, and those who are anxious to make the sugar industry a success are considering Florida and its proximity to Cuba, which island seems to be the garden spot of the world so far as the sugar industry is concerned, and they believe they can make Southern Florida a sugar centre and a sugar producer of far greater extent than has been done in Louisiana. There are so many difficulties and even misfortunes, that attach to the development of any industry in localities where it has not been previously developed to any extent, that it seemed likely that while Florida, and especially Southern Florida, has vast possibilities in the way of sugar-cane culture, it may be a number of years before the development of the sugar industry there along modern lines is fully realized.

Florida as a possible sugar producer can produce sugar-cane satisfactorily up to its northern limits, and in that section of the State known as West Florida along to the westward, and over and beyond Pensacola. The lands there, however, have not the climatic advantage that prevails in Southern Florida, which has the great advantage of immunity from frost all the year round.

The Germans, who have carried the theory of soil improvement to its extremest limits, have said in the past that, give them the soil, and they will make the crops with the fertilizers that they would apply thereto.

Along such lines it is probable that Florida's future progress in the sugar industry would lie, and from the reports of the increasing interest in the industry, it is very possible that the most ardent dreams of the Southern Floridians at the present time may be realized more quickly than would seem possible to conservative judgment.

The demand for sugar as a foodstuff and a confection is at present so great that in the business world it is impossible to satisfy it. Florida should come in to the industry with natural advantages, and avail herself of the present opportunity of the probable ten-year range of high prices for sugar; it is doubtful if even then sugar will get back to its old low level of values, because of the natural increase of population and the general appreciation of sugar's intrinsic merits. So that it is hoped that Florida will take advantage of her opportunity to engage in this great and scientific industry of sugar cane agriculture and cane sugar manufacture.



SEA ISLAND COTTON MARKET.

The report of Messrs. Henry W. Frost. & Co., on Sea Island cotton in the Southern States, for the week ending May 22, 1920, is as follows:—

ISLANDS Since our circular report of April 24, the market has been very quiet. The unsold stock is limited to a few Planters' crops which are firmly held at $1·50, for which there has been no enquiry, the English and French spinners apparently being supplied until the new crop, and there is no demand on account of the Northern Mills for cotton having the fineness and staple of the above crops.

We quote, based on the last sale:—

Fine to Fully Fine.....$1·10, f.o.b. and freight.

GEORGIAS AND FLORIDAS. The Savannah market has remained very quiet also, the limited offerings being held very firmly at high prices, but we know of no demand or sales based on the advanced asked, viz., Fancy, $1·20 to $1·25; Extra Choice, $1·15 to $1·20. Consequently the quotations are nominal.

The sales and exports reported by the Cotton Exchange consist of cotton shipped from the interior, and from stocks held by exporters awaiting shipment on sales made previously.

We quote, viz:—

Fancy.....$1·25, f.o.b. and freight.
Extra Choice.....$1·23, f.o.b. and freight,

with some holders asking higher.

The exports from Savannah since April 24 have been: to Havre 20 bales, Northern Mills 516 bales, Southern Mills 200 bales, and from Jacksonville to Northern Mills 2,376 bales. The shipments from the latter port consist of cotton bought sometime since, and delayed in consequence of no freight having been available.

CROP ADVICES.

On the Islands and coast of Carolina the acreage has been very much reduced on account of the fear of the boll weevil, and consequently it is estimated that the crop may not exceed 1,000 bales.

In Georgia there is a very small acreage planted, although there is some slight increase over last year, so that the crop in this State may slightly exceed the small crop of the past season.

In Florida there is some increase in acreage, the high prices ruling having induced the planters to run the risk of the ravages of the boll weevil.

However, with no serious injury from the weevil, and with an average season, it is thought the crops of Georgia and Florida may amount to only 8,000 bales, which shows some increase over the small crop of last year.

DEPARTMENT NEWS.

Mr. P. Taylor, Clerical Assistant on the Staff of the Imperial Department of Agriculture for the West Indies, is leaving Barbados to-day, June 12, for New York, on three months' leave of absence.

EDUCATION AND RESEARCH CHIEFLY IN RELATION TO SUGAR AND RICE.

NOTES ON A VISIT TO HAVANA AND NEW ORLEANS.

(*Concluded.*)

Turning now from Havana to New Orleans, we naturally give attention first to the Audubon Sugar School. The work of this institution, and of the Bâton Rouge School to which it is affiliated, was described by Dr. Coates in the *West Indian Bulletin*, Vol. XVII, p. 119.

It will serve the purpose of the present article to point out that this Audubon Sugar School has for its function practical instruction in chemical and mechanical control in sugar factory work to University students who, out of crop season, carry on their academic studies at the State University at Bâton Rouge. Located at the sugar school are entomologists and other technical officers of the United States Department of Agriculture, engaged in specific investigations in regard to the sugar-cane; but these officers have no direct connexion with the Sugar School itself.

The Sugar School is composed of offices, a chemical laboratory, and, situated about 200 yards distance, a model factory. This factory possesses a small six-roller mill, which can grind at the rate of about 2 tons of cane per hour. There is no crusher. The juice from the mill is pumped to a sulphuratiug tank, and from there to the defecator or limer Thence it passes to the settling tank; the mud is passed to the filter-presses, and the juice is pumped back to the liquor passing to the evaporators. There is a double effect evaporator having vessels 4 feet in diameter, and there is one vacuum pan. From the vacuum pan the massecuite goes to the mixer, and from there to the centrifugal, when, after separation from the molasses, the sugar is bagged. There is only one centrifugal and one defecator.

The factory in the grinding season is worked almost entirely by students, small squads taking charge of the different processes alternately. A proper sugar factory record is kept by the students for each twenty-four hours, as is done by the chemists in the large commercial factories. The factory is used also for all kinds of experimental work in sugar manufacture; for instance, at the time of Mr. Dunlop's visit, some special investigation was being done in filter-press work. This factory is a splendid institution; every thing is on a small scale, but big enough to get practical results. It is astonishing to think that there is nothing of the sort in the West Indies.

While visiting the Audubon Park School, Mr. Dunlop met Dr. Taggart, who is in charge, and other members of the staff. The greatest courtesy was shown by those gentlemen, and he was given every opportunity of obtaining information, not only in regard to sugar, but in connexion with rice.

At Dr. Taggart's suggestion Mr. Dunlop paid a visit to the Crowley Rice Experiment Station, situated in the Louisiana rice belt about 100 miles from New Orleans. Here Mr. Jenkins, the Agronomist in charge, showed him round, and explained the system of cultivation and irrigation. A large number of small plots are laid out for variety, manurial, and cultivation experiments. The buildings at the Station consist of an office, a variety laboratory, and a pathological laboratory. Several hundreds of varieties of rice have been tried at this Experiment Station, and students from all over the world have

come there to gain an insight into the work done. In regard to varieties of rice, two or three British Guiana varieties, and some Honduras rices have given good results. British Guiana rices appear to be early maturing, but the heaviest yielders are the Japanese varieties. The usual yield of rice at Crowley is about 60 to 70 bushels of paddy per acre, though the yield per acre is usually expressed in barrels of 160 lb. As regards cultivation, this, on the farms, is almost exactly the same as the cultivation of wheat farther north. The only difference is that the land is irrigated for about eighteen weeks. As soon as about 75 per cent. of the rice plants are approaching maturity, the water is drawn off, and the crop allowed to ripen ; after which it is cut with a self-binder like wheat, dried in the field in 'shocks', and then threshed in a large power threshing machine. The paddy is sold to the mills, several of which operate in the town of Crowley. Thirty-five years ago Crowley did not exist, nor was there any rice cultivation in this district. The development has been entirely due to the wonderful irrigation schemes, the result of company enterprise following Government demonstration, whereby water is pumped from bayous, or sluggist black waters of the Missisippi, into canals 30 or 40 miles long. From these canals the farmers can obtain all the necessary water to enable them to grow thousands of acres of splendid rice. But the point to bear in mind is, that the growth of this great industry is directly the result of initial work done by the United States Department of Agriculture.

While at New Orleans Mr. Dunlop was able, through the courtesy of the editor of the *Louisiana Planter*, to visit 'Reserve' Refinery and Sugar Factory, a large concern situated some 25 miles from New Orleans, and to meet the Superintendent, Mr. E. E. Chapin, and the chemists Useful information was obtained in regard to refinery processes, the efficiency of mill work in Louisiana, and the methods of cane cultivation. One of the principal lines of development in sugar factory work is in connexion with clarification. The object is to reduce or to do away with the addition of lime. Kisselgur is being substituted in some places, but one of the latest developments is the Williamson clarifier, which effects clarification by purely mechanical means.

CROP INJURY BY BORAX IN FERTILIZERS.

It has several times been pointed out that cotton soils in the West Indies, especially in the island of St. Vincent, are deficient in potash, and that to maintain their fertility it is advisable for planters to apply a fertilizer containing potash. The use of potash salts indiscriminately is not without some danger however, as is pointed out in Circular 84 of the United States Department of Agriculture, under the title at the head of this article. Many important deposits of potash salts contain a considerable proportion of borax, which has been proved to be very toxic to crops of different kinds, and not least to cotton.

Experiments with a potash salt manufactured from the important deposits of Searles Lake, California, were carried out, under the supervision of the Department, in many of the Northern States on the potato crop, and on the cotton crop in some of the Southern States. It was found that this potash salt contained borax in such a percentage as to have an injurious effect on the crops experimented with. Borax also is proved to occur in other fertilizer material. It has been found in potash nitrate, and it may occur sometimes in appreciamounts in nitrate of soda. It is however perfectly feasible in the process of manufacture to lower the borax content of such potash salt to a very small quantity. This has already been accomplished by crystallizing and washing, so that potash salts are being turned out with less than one-half of 1 per cent. of borax. The same results are quite feasible of accomplishment in the manufacture of potash nitrate and even of sodium nitrate. Safe preparation are therefore available to the planter.

The results of the experiments alluded to above have left no room for doubt as to the poisonous action of the borax on the plants. The quantity of borax exerting this toxic action is small compared to other plant poisons, such as arsenic, mercury, and copper salts. It is considered that 100 lb. per acre of a fertilizer containing only 2 per cent. of borax will cause damage to a crop.

It is difficult to explain the extremely poisonous action of borax, except that it is due to the element boron contained in the borax. Borax is known to be a strong antiseptic, so that a partial explanation may be sought in the sterilizing action which it may have on the soil. Another suggestion is perhaps to be found in the fact that borax is capable of forming a chemical union with sugar alcohols, such as glycerine. It is well known that sugars are liberated in the process of germination, and function in the translocation of carbohydrate materials in the plant, so that it may be that borax interferes with this highly important function, disturbing thereby very seriously the processes of germination and growth. Another suggestion is that its action may be detrimental to the enzyme action which accompanies, and is vital to the processes of germination and growth. Whatever its mode of action, the fact that it seriously interferes with the vital process of plant growth seems now well established. The circular mentioned above presents the results of the experiments undertaken by the Department, for the consideration of the farmer and the fertilizer manufacturer using materials likely to contain borax, so that the borax may be (1) eliminated as far as practicable in the process of manufacture, (2) reduced in the process of mixing fertilizers by a judicious selection of materials, and (3) that with the borax content known, the farmer can use his judgment in order that the amount of borax per acre may be kept within safe limits.

In all the experiments undertaken on cotton, it is shown that the toxic influence of an undue proportion of borax in the fertilizer was most marked, both in the germination of the seeds and the subsequent growth of the plants. It will be therefore wise for cotton planters, in purchasing fertilizer containing potash, to have the percentage of borax guaranteed.

Cotton growing is assuming large proportions in the South West of the United States. The raising of Pima long staple cotton is expected to benefit much the rapidly growing rubber manufacturing industry in Southern California. It is stated in an article in the *India Rubber World*, May 1, 1920, that in California and Arizona 200,000 acres are now producing cotton. It is estimated that a yield will be produced of 100,000 bales of 500 lb. to the bale, which, at the guaranteed price, will be worth at least $30,000,000 apart from the seed, which will be worth about $5,000,000 more.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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NOTES AND COMMENTS.

Contents of present issue.

The editorial draws attention to the value of belts of trees, not only as a protection against wind, but as a prevention against soil erosion on slopes.

Damage done by the acrobat ant to cacao trees forms the subject of an article under Insect Notes on page 186.

Some interesting experiments undertaken in St. Croix on the cultivation of sugar-cane are the subject of an article on page 180.

The possible injury resulting to crops by the application of artificial fertilizers containing too large a percentage of borax, is the subject of an article on page 183.

The various kinds of sugar syrups on the market are described on page 190.

The Late M. Philiple Boname.

The *Bulletin de la Société des Chimistes*, Mauritius, January 1920, which has just been received at this Office, records the death in France of M. Philippe Bonâme, formerly Director of the Station Agronomique, and Assistant Director of the Department of Agriculture of Mauritius. M. Bonâme, when quite a young man, was appointed in 1877 as Director of the Station Agronomique of Pointe-à-Pitre, Guadeloupe, and for some years devoted his attention to the study of tropical agriculture, especially in relation to sugar-cane cultivation. In 1892 M. Bonâme was appointed Director of the Station Agronomique in Mauritius, where he remained until 1914.

M. Bonâme rendered great services to the cause of scientific tropical agriculture, particularly in relation to the cane-sugar industry, services which will cause his name to be long remembered by those connected with the industry in question in all parts of the world. His book 'Cultur de la Canne à Sucre' is still referred to as an authority by writers on the sugar-cane.

The Late Mr. J. C. Moore.

We regret to have to record the death in England of Mr. J. C. Moore, late Superintendent of Argriculture, Grenada.

Mr. Moore, having been trained at Kew, was appointed Curator of the Botanic Gardens, St. Lucia, in 1895, and was made Agricultural Superintendent of that island in 1898, when the Agricultural Department was reorganized. He held that post until 1914, when he was transferred to Grenada as Superintendent of Agriculture. Owing to failing health he retired on pension in 1919.

Mr. Moore has a record of good work done in both the islands in which he presided over the local Botanic and Experiment Stations. He was largely instrumental in establishing the successful Government Lime Juice Factory in St. Lucia, and mention may be made also of the good results attained by his energetic campaign for the enlarged production of local foodstuffs in Grenada during the three years before his retirement.

Tanning Fish Leather.

A note in the *Journal of the Royal Society of Arts* May 7, 1920, states that excellent progress in the tanning of fish leather is recorded by the United States Bureau of Fisheries, and a number of difficulties in the way of the development of the industry have been overcome.

One company, which is tanning fish skins, has established a station in North Carolina and another in Florida, for the capture of sharks and porpoises, and is meeting with success in its fishery for sharks. It is understood that the number of stations will be increased as rapidly as possible. Another company has recently acquired a site for a tanning establishment in Washington, for the purpose of tanning the hides of sharks, beluga, seals, etc. Samples of

leather recently submitted to the Bureau show marked improvement in appearance compared with earlier samples. The leather is soft and pliable, and appears to have ample strength for many uses.

The nets which the Bureau developed for the capture of sharks are proving successful, and are being adopted for the fishery. At the fishery stations the oil is extracted from the shark livers, and the flesh is converted into fertilizer, so that no material is wasted.

Seed Electrification.

Attention is drawn in *Nature*, May 13, 1920, to a Bulletin (No. 11) published by Messrs. Sutton and Sons, the well-known gardeners of Reading, dealing with seed electrification. The bulletin records results of a number of germination and field tests carried out in 1919 with seeds of carrot, swede, cabbage, and mangold. The process of seed electrification, known as the Wolfryn process, consists in immersing the seeds in a solution either of common salt and water, or of calcium chloride and water, through which an electric current is then passed. After this treatment the seeds are dried at a temperature of 100 F., and they are then ready for sowing. It is obvious that two processes are here involved, seed immersion and seed electrification; and the Reading experiments were designed in the first place to test the value of the Wolfryn process; and in the second place, if there is any value in it, to decide whether that is due to the immersion, to the electrification, or to the combination of both. Tests were made with untreated seeds, with seeds electrified by the Wolfryn process, with seeds soaked in a solution of sulphate of ammonia, and seeds soaked in a solution of salt and water of the same strength as that used in the Wolfryn process.

Regarding the tests as a whole, they did not show any advantage from seed electrification, the only possible exception occurring in the case of mangold seeds, which, when electrified, yielded in the fields 62 per cent. more than the untreated seed. In all other cases the electrified seed gave a lower yield than the seed treated in other ways, or the increase following electrification was so small as to be negligible.

Recent Plant Quarantine in the United States.

In order to prevent the introduction into the United States of the European corn borer (*Pyrausta nubilalis*), and also of other dangerous insects and plant diseases, Mr. E. T. Meredith, U.S. Secretary for Agriculture, has issued a notice dated February 21, 1920, forbidding the importation into the United States from all foreign countries and localities of the stalk and all other parts, whether used for packing or other purposes, in the raw or unmanufactured state, of Indian corn or maize (*Zea Mays*); the following varieties of *Andropogon Sorghum*, namely, sweet sorghums, grain sorghums, broom corn, and Sudan grass; also of Johnson grass (*Andropogon halepensis*); sugar-cane (*Saccharum officinarum*) including Japanese varieties; pearl millet (*Pennisetum glaucum*); Napier grass (*Pennisetum purpureum*); teosinte (*Euchlaena luxurians*); and Job's tears (*Coix Lachryma-Jobi*).

This prohibition is to remain in force until further notice.

West Indian Coffee.

A note in the *West India Committee Circular* April 15, 1920, draws attention to the fact that the prohibition in the United States of alcohol has drawn public notice to the increased use of non-alcoholic stimulants, among which coffee figures largely. For many years coffee has been a favourite drink in the States.

It may well be expected that the consumption of coffee will be extended in the future, not only in the United States, but largely throughout the world; and the notice of planters in the British West Indies may well be directed to the possibilities of its cultivation. Sir George Young, in his 'West India Common Place Book', gives the exports of coffee from the British West Indies in 1804 as 232,809 cwt, of which 176,531 cwt. came from Jamaica; in 1916 Jamaica only exported 69,956 cwt. In 1803 Dominica exported 44,000 cwt.; it now exports practically none.

It is true that tea has during the last century largely superseded the general use of coffee in England, but there are signs of its coming into greater favour again. There is this point to be considered, that, as a stimulant coffee supplies more nutriment than tea, and is not so likely to interfere with the digestion; nor does it irritate the nerves in the same manner. It may be hoped that coffee will again take its place in general West Indian exports, seeing that there are many parts of the British West Indies which are eminently suitable for its cultivation.

Hogs in the Philippines.

The Annual Report of the Bureau of Agriculture of the Philippines for the year ended December 31, 1918, calls attention to the possibility of improvement in the breed of hogs in those islands. Experiments, both at Government stations and at private farms, entirely justify the importation in large numbers of the Berkshire and the Duroc-Jersey breeds. These breeds have proved entirely suitable to Philippine conditions, and they also produce excellent results by crossing with the native pig. Their early maturing qualities and general handsome appearance have caused great interest to be taken in them by the native farmers. It is stated that another breed of hog which would probably find acceptance in the Philippines, considering that the trade requirements there are for lean pork, is the Tamworth, a breed belonging to the bacon type. It is not considered that white breeds of hogs, such as the Yorkshire, would thrive under lowland conditions in those islands.

THE BLACK OR ACROBAT ANT AS A PEST ON CACAO TREES.

In an article in the *Agricultural News*, October 9, 1915, Mr. H. A. Ballou, Entomologist on the Satff of the Imperial Department of Agriculture, pointed out, on his return from a visit to Grenada, that it seemed likely that the acrobat ant might become a serious pest in that sland.

In his report just published in the Report on the Agricultural Department, Grenada, 1918-19, after another visit in January 1919, Mr. Ballou's remarks on the same subject, which are largely quoted below, appear to lead to the conclusion that his former diagnosis was correct. On an estate where a small area of apparently healthy cacao had ceased to bear, it was said that this was on account of the abundance of mealy-bugs and black ants. Some of these trees were being cut down and burned.

The trees were healthy, so far as could be seen, and they were in good foliage and provided a reasonable cover. Although the mealy-bug was rather abundant, it does not seem possible that the attack by these insects was sufficiently severe to cause the trees to stop bearing. Black ants also were extremely abundant, and might have been causing a good deal of injury to the trees, but even so, it is not easy to see how either the ants or the mealy-bugs, or the combination of these insects could have put a stop to the bearing of the trees without causing more damage than was apparent.

It was said that this attack had persisted on the same trees for the past three years, and systematic attempts should have been made to free the cacao from these pests. It is known that the mealy-bug can be controlled by spraying, and it would have been very easy to experiment at the same time in the use of a suitable wash for reducing the numbers of black ants. Scalo, the formula for which could be easily obtained from the Superintendent of Agriculture, or from the publications of this Department, would probably be found very effective as a spray for mealy-bug.

While in Grenada Mr. Ballou made trial, in conjunction with the Superintendent of Agriculture, of insecticides suitable for treating black ants and mealy-bug; and a series of preliminary trials indicated that a wash containing 5lb. of Scalo and ½ lb. of 'Black-Leaf 40·' in 40 to 100 gallons of water, is a satisfactory insecticide for this purpose.

It must be borne in mind, however, that any spraying for the control of black ants must be preceded by careful cleaning of the tree. By cleaning in this connexion is meant the removal of all dead stubs, dry pods, loose bits of bark, and in fact everything which might make a cover in or under which the ants might hide and find protection. The black ant lives in small colonies. A bit of bark raised by a cutlass cut, the rotting wood in wounds of all sorts form excellent places for their nests. On one estate attention was called to the fact that in a certain field none of the trees were bearing on the trunks and larger branches, and it was pointed out that the ants had invaded practically every cushion. With the point of a knife these dead cushions could be easily turned out, and in every instance ants were found inside. They entered sometimes through the central pith in the stems of the pods that had been cut, and more often apparently by means of small holes at one side near the base of the cushion. It is not possible to say that the ants had killed all these cushions, or even that they had killed any of them, but the indications are that they had at least helped in bringing about this condition.

On the estate referred to, where the mealy-bugs and black ants were so abundant, the ants had not invaded the cushions on the stem to the same extent as in the case of the other estate, but they were found in many dead cushions, and there seems to be no doubt that they were doing a certain amount of damage by attacking living tissue in many places where wounds of one sort or another had given them easy access to it. The trees at this place were covered over all thier trunks and branches with black blight.

At this place also it was reported that black ants and thrips do not occur on the same trees. That is to say, that trees on which black ants are very abundant are not the trees which are subjected to severe thrips attack; and this may be the reason why some cacao planters in Grenada were under the impression that the ants were inimical to thrips, and that the introduction of ants into cacao fields suffering from thrips attack was likely to prove a means of control. Red ants are said to occur in these places where severe attacks of thrips are experienced.

In conclusion, it may be said that mealy-bug can be controlled by spraying, and preliminary trials indicate that black ants can also be satisfactorily controlled, provided all their hiding places on the tree (that is, on the trunks and large branches) can be cleaned up in such a way as to expose the nests of these insects to the action of the spray material. This is necessary in order that the egg-laying females and the young in the nests may be killed.

THE ALGAROBA TREE.

In the *Agricultural News*, March 20, 1920, there appeared a note referring to the original algaroba tree (*Prosopis juliflora*) which had been brought to Honolulu nearly 100 years ago. Attention was drawn to the benefits which that tree had conferred on the Hawaiian Islands, so that in the words of the *Hawaiian Forester* and *Agriculturist* 'the algaroba tree has well earned its place today as the most valuable tree in Hawaii.'

From *Agricultural Extension Notes*, No. 26, published by the Porto Rico Experiment Station, Mayaguez, May 15, 1920, it appears that the tree is well suited also to certain West Indian conditions. The algaroba was introduced into Porto Rico by the Experiment Station, and thousands of seedlings have since been distributed from the Station. A great number of specimens can now be

found in the pastures, especially on the south side of the island. Throughout the lands belonging to Guanica Sugar Central, special pains have been taken to distribute it. It is stated that in Porto Rico it succeeds best on high and dry lands, but it will grow in all parts of the island. At the Mayaguez Station, which is on the west side of Porto Rico, it has been found that by close planting and frequent trimming, the algaroba makes a very beautiful hedge. It is advised that all pasture land throughout the island should be planted with this tree, which is valuable for many reasons. Being a leguminous tree it improves the soil on which it grows, and such a crop as Guinea grass grows well under its shade. In the next place it is a handsome tree, and from an aesthetic point of view is desirable in the landscape. The flowers are much visited by bees, which manufacture from them honey of excellent flavour. The pods, which are filled with a sweetish pulp surrounding the seeds are greatly relished by live stock. The wood makes an excellent fuel, and, when the tree attains sufficient size, the wood is also valuable for building purposes. The note referred to above hopes that this tree may be generally planted throughout the island, so that in future years it may be said in Porto Rico, as in Hawaii, that it is the most valuable tree on the island.

The West Indian locust (*Hymenaea Courbaril*) is locally known in Porto Rico by a very similar name, 'algarrobo', but the latter is quite a different tree from the algaroba (*Prosopis juliflora*).

A MACHINE FOR TRIMMING CAMPHOR TREES.

The United States Department of Agriculture published in February 1920, Circular No. 78, giving a description of a machine constructed by that Department, which has been successfully employed in place of hand labour for the purpose of trimming camphor trees in Florida. The circular referred to describes the present position of camphor cultivation in the Gulf States as follows:—

The production in the United States of gum camphor from the leaves and twigs of the camphor tree (*Cinnamomum Camphora*) has reached a stage where there exists a demand for machinery to replace hand labour in the harvesting operations. The first step in the production of gum camphor, after the trees have been established on the plantation, is the removal of the new growth of leaves and twigs. At two more or less sharply defined seasons of the year the camphor tree becomes dormant, at which times the leaves and twigs may be removed without injury of the tree. When hand labour is employed to remove this material, which usually consists of small branches of varying diameters, rarely exceeding 1 inch, the cost is found to be excessive. Also, the trees, instead of receiving merely a clipping of the small branches, very frequently receive a severe pruning, which is detrimental to their growth. This severe pruning causes the trees to assume unnatural shapes, and destroys the symmetry of the row. It also causes the trees to throw out abnormal growths at the ends of the pruned branches and trunks, thereby making subsequent prunings more and more difficult.

It is an established fact that camphor wood of one or two years' growth contains relatively small proportions of camphor, whereas the leaves contain a relatively large per centage. The quantity of wood which is removed by severe pruning is greatly in excess of the leaves. Severe pruning therefore increases the weight and bulk of the green material to be handled in the field and at the distilling plant without appreciably increasing the weight per acre of the camphor obtained. Considerable expense is also incurred in distilling this bulky camphor brush, which does not contain sufficient gum camphor to pay the cost of handling and distilling, and of removing the refuse from the stills. Furthermore, it has been demonstrated experimentally that as the camphor tree increases in age, the proportion of camphor in the trunk and limbs also increases. The leaves and young limb growth always contain relatively large amounts of camphor; hence, if only the leaves and new growth are removed each dormant season, the remaining old limbs and trunk will be gradually increasing in camphor content, and if at any future time it becomes desirable or expedient to cut down and distil the whole tree, the yield of camphor obtained will be large in comparison with the bulk and weight of the green material handled.

The price of labour has gradually increased, until the point has been reached where hand clipping, even when done with care so as to preserve the trees and to remove only the best camphor producing material, has become so expensive as seriously to threaten the profitable production of gum camphor in the Gulf States.

To remedy this state of affairs, the Department set itself to devise a machine for clipping the leaves and twigs from camphor trees when planted in rows; to make such a machine as simple and easy to operate as possible; to construct the machine in such a manner that the leaves would not be injured in clipping; and to produce a machine that would clip a large portion of the leaves and twigs available for distillation.

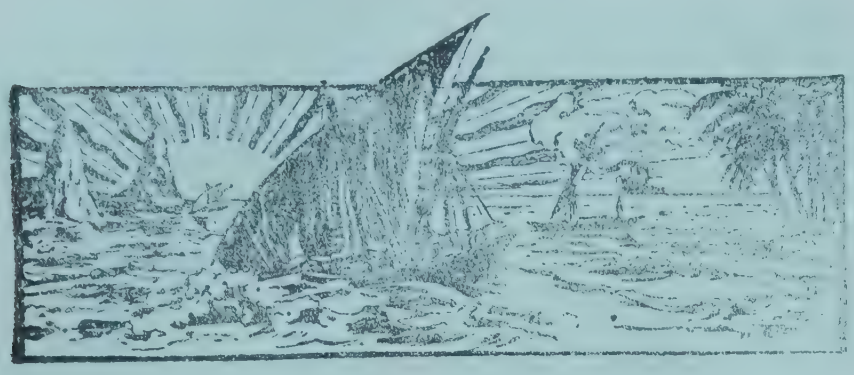
After some preliminary efforts, the Department has succeeded in producing a machine which fulfils the above conditions. A full description, along with illustrations and diagrams, is given in the circular referred to above.

Considering the widespread interest that is being taken in the possibilities of camphor production in the British Empire, such a trimming machine is worth paying attention to.

The operation of the machine is not difficult, requiring only the necessary attention and care given to any similar farm machinery. Three men are expected to operate the machine when mules are employed, but it is believed that two men will be able successfully to operate machines driven by tractors. Such machines are now under construction by private interests, and their construction is based on the results obtained by the experimental machine described in the circular.

This camphor-trimming machine was constructed by the United States Department of Agriculture, and a patent has been applied for which will contain a proviso dedicating it to the use of the public.

It is estimated that the number of acres now under cotton cultivation in Nyasaland is 32,850, with a possible extension to 1,309,000 acres. The cotton grown is known as Nyasaland Upland, and comes from a long stapled American variety. The natives take easily to cotton raising. There is a fair amount of native labour for the European plantations, and many natives are beginning to raise cotton independently. (The *India Rubber World*, May 1, 1920



GLEANINGS.

The sugar crop in Jamaica this year is not expected to be as large as was anticipated in several of the cane-growing districts, owing to adverse weather conditions, but, on the whole, the island's output of sugar, it is estimated, will exceed that of any previous year, while the output of rum for which Jamaica is celebrated, will also be a good one. (*Sugar*, April 1920)

In a note in *The Board of Trade Journal*, May 13, 1920, it is stated that the development of the cotton industry is one of the most outstanding industrial developments in China at the present time. According to the data, China now ranks third in the production of raw cotton, with almost 2,000,000 bales of 150 lb. In 1919 the area under cotton was increased 30 per cent.

In a note in *Botanical Abstracts* March 1920, on mahogany and some of its substitutes, it is stated that representatives of thirteen botanical families and twenty-seven genera embrace woods known in the trade as 'mahogany,' or used as substitutes for the wood to which this name most properly belongs. Of the general, eleven belong to the same family, Meliaceae, to which the true mahogany (*Swietenia Mahagoni*) belongs

The amount of proof spirit delivered from bond in the United Kingdom for the purpose of methylation, or for use in the arts and manufactures, during the three months ending March 31, 1920, was 36,745 gallons. Molasses can be imported free of duty for the purpose of manufacturing industrial alcohol. The industry is still in its infancy, as the above quantity would only be equivalent to about 550 puncheons of molasses—at the rate of 2,200 puncheons per year. (The *West India Committee Circular*, April 29, 1920.)

In an article on progress made in sugar manufacture and utilization of by-products in Hawaii, the *International Sugar Journal*, April 1920, reports that the Maui Agricultural Company is utilizing a portion of waste molasses for the production of motor alcohol for the operation of trucks, tractors, automobiles, etc. It is produced at the rate of 350 gallons per day, and not taking into account the molasses, the cost per gallon is about 8c. One ton of molasses, produces 60 gallons of the spirit. This scheme is a successful one.

In *Facts About Sugar*, April 17, 1920, it is stated that never within the memory of the present generation of sugar traders has there been such a scramble for refined sugar as was the case during the preceding week in the United States markets. Demand had become desperate appeal with price a secondary consideration among buyers. Reports of the shortage in the Cuban crop, and of the rapid rise of prices in the raw sugar market, had spread to every corner of the country, with the result that consumers and retailers, as well as manufacturers and jobbers were clamouring in the markets for sugar in any quantity, and on any terms.

The six-year-old British Friesian cow, Colton Secret III, the property of Mr. G. Helt Thomas, North Dean, High Wycombe, Burks, is credited with the extraordinary record of $105\frac{3}{4}$ lb. or $5\frac{3}{4}$ Imperial gallons of milk in one day. She was milked three times, morning, midday, and evening. This figure is the highest ever reached by a cow of any breed in England. It is not surprising that the quality of the milk was not equal to the quantity. The quality of the morning and midday milk would have rendered the owner open to prosecution on the grounds of presumed dilution. (*The Field*, May 1, 1920.)

In a note on the oleander, the *Field*, May 1, 1920, states that some authorities recognize two species of this well-known garden plant. Whether it was originally from Persia, or whether it spread from the Himalayas to the various countries where it is now common, is doubtful. There is nothing tangible to distinguish the Indian plant, *Neriun odorum*, from the Persian, *N. oleander*. The poisonous milky juice of this plant is employed in the preparation of various eastern drugs used in cases of skin diseases, including leprosy. The flowers are considered sacred by the Hindoos.

The product of Santo Domingo which is most likely to interest British commercial men is sugar. In view of the world-wide scarcity, the production of sugar in this Republic should increase very rapidly. The chief obstacle is scarcity of labour. Sugar can be produced much more cheaply there than in Cuba. The sugar companies at present in the Republic, who operate mostly with American capital, are making enormous profits, and there are still large tracts of virgin soil, so that the future of the industry looks very promising. (*The Board of Trade Journal*, May 13, 1920.)

With the increased demand for high grade paper pulp, Canada contemplates supplementing her resources from pulp wood by using flax straw. At the present time flax straw is burned and wasted wherever flax is grown for linseed, the straw crop representing a loss of about 1,000,000 tons of raw material. It is now definitely stated that a use for flax straw has been demonstrated in the manufacture of pulp for conversion into high grade papers. All that is required is co-operation on the part of farmers, and the necessary capital to organize the new industry. This would be a very important factor in extending the cultivation of flax in the Dominion, and at the same time stimulating the important paper industry of Canada with a supply of high quality pulp. (The *Chamber of Commerce Journal*, May 14, 1920.)

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

DOMINICA. The lime crop from the Lime Experiment Station during the month of May was 32 barrels of fruit. Owing to the dry weather there was no plant distribution. The local price for ripe limes and products thereof, Mr. Keys, Acting Curator, states, remained unchanged; the price of green limes dropped to 10*s.* to 12*s.* per barrel. The rainfall for the month was 2·38 inches.

MONTSERRAT. The continued drought has seriously interfered with work in the Experiment Station, and Mr. W. Robson, the Curator, says that planting of crops has not been possible during the month of May. Plant distribution from the Station only consisted of 36 lb. of ground nuts, and 28 packets of various beans. Six distillations of bay leaves were made during the month; they yielded an average of 28·3 oz. of oil per 100 lb. of leaves; the high yield is probably due to the continued dry weather. Of the 1,700 camphor seeds sown, 88 have so far germinated. Experiments are being made with regard to keeping seeds of desirable strains of cotton for planting purposes by (1) placing them in cold storage, and (2) storing them over quicklime. With regard to the cotton crop, Mr. Robson states that all the cotton planted in March is dwarfed and stunted, and is beginning to develop bolls. Owing to the drought there has been little opportunity to supply irregular fields, or to establish fresh areas; the outlook at present is not very encouraging. The area under cotton in Montserrat during the year 1919 has been finally estimated at 3,200 acres, which means that an average return of lint was obtained throughout the island of 171 lb. per acre—the best return since 1910. Towards the end of last year it was noted that a bale of dried plants of *Datura Metel* had been shipped for examination to London. As the result, an enquiry has been forwarded to Montserrat for from 2 to 5 tons of the same material, quoted at 1*s.* 6*d.* per lb., delivered in London. The continuation of observations on the various strains of the Montserrat cotton are likely to be seriously interfered with by the abnormally dry weather. The destruction of silk-cotton trees is proceeding, 100 trees of different sizes having been felled during the month. The rainfall registered at Grove Station for the month was 1·12 inches, making a total for the year of 13·69 inches.

ANTIGUA. During the month of May the following constituted plant distribution: selected cotton seed 1,475 lb.; decorative plants, 12; vegetable seeds, 27 packets; Saman seeds, 2 packets. Ordinary routine work was performed in the Botanic Garden. Mr. Gallwey states in connexion with staple crops, that as a result of good rains which fell during the month, the young cane crop in some districts has improved. Owing to the continued dry whether in the cotton-growing districts, the planting of this crop has been delayed. A moderately large area of land is under preparation by estates for the planting of ground provisions. The rainfall for the month was 1·27 inches; the total precipitation for the year to date is 8·35 inches.

ST. KITTS. After some light showers about the middle of May, cotton seed was planted in the manurial experiment plots, and from the progeny rows. The weather since then has been so dry that no more planting has been possible. Mr. F. R. Shepherd, the Agricultural Superintendent, states that the condition of the Botanic Garden is distressing. As there is no water available for watering the plants, many of the trees are dying, and the lawns are parched. No work of any kind can be done beyond cleaning up, and trimming hedges. Reaping the plots of sugar-cane varieties has been completed at La Guérite, and at Molineux and Estridges. The cane also from the manurial plot at La Guérite has been reaped. Considerable progress has been made towards finishing the reaping of the old cane crop during the month, and the Basseterre Factory expects to close down about the end of June. The canes reaped are exhibiting the effects of the prolonged drought in loss of weight. The young cane crop is suffering, and the later planted fields are dying out in many places. Unless the weather breaks, and rains fall, the prospects for the next crop will be poor. With regard to cotton crop, fields planted in February and March in the northern district are looking fairly well, but it has been impossible to complete the planting in that district owing to the drought; and for the same reason very little cotton has as yet been planted in the Basseterre district. The rainfall for the month was 2·08 inches, making a total for the year of 11·73 inches.

AGRICULTURE IN BARBADOS.

Except in one or two localities, the rainfall for the month has not exceeded an inch, and the amount which fell in May last year is twice as much as what we have had this month.

In the black soils the young plant canes are still holding out well, and in Christ Church, bordering on the sea coast, they have developed very few yellow blades. In the red soils, unless a few heavy showers fall, dry hearts in the bunches will soon be revealed.

The B. H. 10 (12) ratoons look well, and are better than those of any other variety; those of the B. 6450 are not up to their usual standard, as they cannot stand much dry weather.

During the fortnight before this, a few fields were prepared for yam beds, but no yams could be planted or further tillage made. It is advisable that the best tillage be made for yams, and healthy cuttings be planted, or else the yam crop will be a poor one.

With coming rains, green dressing should be planted as quickly as possible, so that there will be good foliage to be turned in before the fields are prepared for plant canes. The old-fashioned bonavist is a superior dressing. It covers the land quickly, and yields a fair amount of nitrogen.

Here and there we see corn holes dug for planting imphee seed, which should be planted at the first opportunity, in order that the fodder situation may be relieved. At this time fodder is very scarce, and in some places unobtainable, and estates which have ceased reaping have had to resort to vacuum pan molasses sprinkled on dry cane tops. The price of fodder in the rural districts is 80c. per 100 lb., in the city 6*s.*

Ground provisions are becoming scarcer each day, and as soon as rain falls a fair amount of corn, beans, and other vegetables should be planted to relieve the present situation. Potatoes are being retailed at 4c. per lb.

The breadfruit season is practically closed, and as the banana industry is neglected, there is no other source of supply for the poorer people. (The Barbados *Agricultural Reporter*, May 29, 1920.)

SYRUPS.

Attention was drawn to the manufacture of cane syrup in an article which appeared in the *Agricultural News*, January 24, 1920; this was chiefly quoted from a paper on the subject by Dr. H. A. Tempany, in the *West Indian Bulletin*, Vol. XIII, page 324. Cane syrup, however, is not the only variety of sugar syrup which is placed on the market.

A very interesting article on the manufacture of table syrups, by Cleve W. Hines, Sugar Technologist, Philippine Islands, appeared in the *Louisiana Planter*, April 17, 1920, in which the various kinds of sugar syrups, and their distinctive characteristics, and the methods of manufacture are described. Much of this article is reproduced below.

Syrup is one of the most wholesome of foods and is also one of the cheapest and most convenient to handle of all the forms in which sucrose and invert sugars are found on the market. During the process of digestion, sucrose is first split up into two sugars known as invert sugars, or glucose and fructose, by enzyme invertase contained in the intestinal juice, before it can be assimilated.

In case the sucrose has already been crystallized, it must be dissolved before the enzymes can act upon it. Preparing the sucrose in a crystallized form, in order to have it available for food purposes, would therefore appear to entail an unnecessary loss of labour and expense. But, as is pointed out below, crystallized sugars are far more easily handled in bulk than syrups.

High-grade granulated sugar is very nearly chemically pure sucrose, for it has a purity of upwards of 99 9 per cent. It has, however, only the sweet flavour common to the chemical sweet saccharine, and practically none of the delicate flavour and pleasant odour which made the rich Demerara crystals famous a few decades ago. And it was the rich syrup surrounding the crystals that made that sugar superior to all others. In the process of refining sugar all of the syrup adhering to the crystals of sucrose is removed, and becomes a by-product, while, as mentioned before, the delicate flavour of the sugar is thereby impaired.

It is not to be presumed that all sacchariferous products should be used only in the form of syrups, for they are more bulky to transport; special containers are required for them; and greater precautions must be taken to prevent them from deteriorating by bacterial action, not to mention the fact that syrups do not always meet the desire of fastidious consumers, who demand sweets that are snow white and crystalline in appearance, rather than those with the rich golden colour and the delicate flavour nature herself gave them.

There are a great variety of syrups made commercially, containing one or more of various substances, including sucrose, invert sugars, organic non-sugars, and mineral substances in different proportions. These are derived from numerous sources, among them being the sugar-cane, sweet sorghum, sugar maple, and sugar-producing palms. It has been recommended that syrup be made from sugar beets also, but due to the composition of the impurities contained in the juice of beets which consist largely of compounds that are unpleasant to the taste, the sugar beet has not received much attention as a source of syrup.

CANE SYRUP.

This syrup consists of the juice of the sugar-cane, boiled to the required consistency after receiving proper clarification, the degree of which depends upon the condition of the orignial juice, and the grade of syrup desired.

There is, however, a variation in the purity of cane juices received during a grinding season; some containing as high as 94 per cent. of the total solids in the form of sucrose, while others have as low as 50 per cent. or less. The low purity of a cane juice, however may not always indicate an extremely low yield in syrup, though there is usually some diminution; nor does it necesarily give a syrup of an inferior quality. But it may give a syrup of an entirely different flavour and other characteristics, especially if it results from over-maturity. It has been recommended by some syrup makers that immature cane be used in preference to ripe cane, in order to make a syrup in which the sugar will not crystallize.

Some varieties of cane are of a lighter colour than others. These usually give a light coloured juice, and in consequence a lighter syrup, especially when but little attention is given to clarification. This is one of the reasons why D.74 became so popular among syrup producers in Louisiana a few years ago.

A thing of importance in making high-grade syrup is to have the juice in process during the shortest possible period of time. A much lighter coloured syrup thereby results, and the grade of the finished product will be determined to a great extent by its appearance.

SORGHUM SYRUP.

The ordinary sweet sorghum contains a high percentage of sugar as well as a great deal of gummy material and other non-sugars, such as those responsible for the molasses resulting in the manufacture of sugar from sugar-canes, and some of these impart the characteristic flavour of sorghum to the juice and syrup.

Analysis shows that there is a great variation in the composition of juices from the different varieties of sorghum, as well as from those grown at different places, and under different conditions.

There is a great quantity of sorghum syrup, often incorrectly called molasses, made in the United States each year.

A great amount of this is invert sugars; but, if these are pure and have been properly handled, they are just as wholesome as sucrose.

MAPLE SYRUP.

Of all the various kinds of syrup found on the market, maple syrup is perhaps the most highly prized, and consequently the most expensive.

The work of preparing for the 'sugar run' is started during the winter, so that everything may be in readiness to take advantage of the freezing and thawing weather which causes the sap to flow at the beginning of spring.

The sap of the maple contains a low percentage of sucrose as well as invert sugars, consequently a great deal of water must be evaporated to reduce it to the syrup condition.

The quality of this syrup is judged by the critical eye and keen taste of syrup merchants in the same manner as they judge cane syrup.

PALM SYRUP.

The sap which flows to the flowers of a number of tropical palms contains a high percentage of sugars, and the sap of some of them also contains non-sugars that lend a pleasant flavour to finished syrup made from the sap.

Syrups have been made from the sap of palms by the natives of tropical countries from time immemorial.

GLUCOSE SYRUP.

There are various syrups on the market consisting almost entirely of commercial glucose or a combination of the various monose sugars. These are excellent foods when properly made, and if none of the chemical used as an inverting agent is left in them, or if it is subsequently removed before the syrup is placed on the market.

Glucose syrup is made from starch, and is sold under various trade names; in America it is quite often called 'corn syrup.' The main reason for its receiving this name is that the starch from corn is sometimes used in its manufacture. In Europe the starch from potatoes and rice is also used for this purpose. There is no essential difference in the syrup made from these starches, except in the details of manufacture. The principle used in the making of this syrup is to boil the starch with a powerful acid, such as sulphuric or hydrochloric, which exerts a hydrolytic effect upon it, splitting it up into its component parts, and thus producing commercial glucose.

With many persons there is a prejudice against glucose syrups, because of the fact that glucose is a prepared compound, and is largely used as an adulterant in perserves and other delicacies, to take the place of the more expensive sugar-sucrose. If these syrups have been properly prepared, and no foreign matter admitted, they make very good foods, but they always contain a certain amount of the chemicals used in decomposing the starch. While glucose has not an unpleasant taste, at the same time it would not appeal to the palate unless given some artificial flavour; for this reason each factory making this class of substance usually turns out a syrup with a peculiar flavour calculated to enhance its popularity.

Sucrose is easily split up into the two invert sugars dextrose and levulose, with only an infinitesimal amount of the inverting agent. Invert sugar syrup can therefore be manufactured from sugar cystals. Consequently the trifling amount of impurity left in this syrup will do no harm, and where sugar containing a film of rich golden syrup around the crystals, such as good grades of 96° test sugar, or the famous Demerara crystals are used, a syrup may be made with the characteristic cane flavour and rich golden colour so much desired.

The *International Confectioner* is the authority for the following simple instructions for conducting the inversion process in making high-grade glucose syrup:—

'Cane or beet sugar (sucrose) can be inverted by the simple process of heating in the presence of an acid. The following formula may be used in making invert sugar syrup:—

100lb. of sugar
44lb. of water
50 grammes of powdered tartaric acid.

'These ingredients are mixed together, and boiled for from thirty to thirty-five minutes. If boiled longer than thirty-five minutes the syrup darkens in colour, and a flavour develops which tends to make the syrup resemble glucose syrup, and this is somewhat undesirable. This solution boils at a temperature of 220° F.

'The above formula should make 140lb. of syrup, and if there is considerable loss, due to evaporation, the syrup can be brought up to this weight by the addition of water. The resultant invert sugar syrup is not unlike strained honey in appearance and taste. It contains about 71·4 per cent. of sugar, and it tastes considerably sweeter than a sugar syrup of the same strength, and it does not crystallize.'

NATAL GRASS.

In the *Agricultural News*, December 1, 1917, attention was drawn to the introduction of a grass into the West Indies, chiefly for ornamental purposes, on account of its feathery flower spike of a bronze red colour. This grass is known as Natal grass, being a native of South Africa. Its botanic name is *Trichotaena rosea*. It was pointed out in the article referred to, that this grass was considered of value as a forage grass both in South Africa, its native habitat, and in Brazil where it is widely cultivated as a hay crop.

From *Agricultural Extension Notes*, No. 24, of the Department of Agriculture, Porto Rico, it would appear that this grass is being favourably considered in that island as a hay crop. It has been tried in various localities in Porto Rico, and has been found very promising, especially on sandy soils. It not only grows readily when sown in prepared fields but, as it does in Barbados, it spreads voluntarily to uncultivated lands as well.

The article referred to says that, like many other introduced grasses, Natal grass is not well suited for pastures. It looks as though it ought to make a fine pasture, as it is a short grass, of about the same height as the Barbados sour grass, and, like that, soon covers the ground well. It is, however, an annual grass, dying down, and being reproduced only by seed. It therefore has been found that it is chiefly valuable for hay and silage. Reports from Florida, where the grass has been experimentally cultivated, indicate that the feeding value of Natal hay is about equal to that of timothy. It is reported from Porto Rico that experiments made with feeding green Natal grass to milch cows show that its quality is equal, if not superior to that of Guinea grass.

It is stated that on the heavier soils, especially in rainy districts, Natal grass will not give as high a yield per acre as elephant or Napier grass; but in lighter soils, and in districts subject to periodical droughts, the note referred to above considers that it is undoubtedly the most profitable grass at present cultivated in Porto Rico.

As was stated above, Natal grass is an annual, and is propagated by seed. It seeds abundantly, and, when it is once introduced, seeds may be collected in any quantity. Seeds may be also obtained from dealers in the United States, especially those who cater for the Southern States. The time of planting will vary according to atmospheric conditions. Probably, as a general rule, May would be the best month for sowing the seeds in these islands, just before the ordinary rainy season sets in. In preparing the land for seed, the soil should be well pulverized and weeded. If the land is fairly clean, the seeds may be sown broadcast, and no further cultivation will be needed.

Now that the subject of ensilage is attracting attention in these islands, annual grasses which will yield a crop, and then leave the land free for other plantings, are worth while considering. For the purpose of ensilage, such a grass as Natal grass, especially if intermixed with indigenous leguminous plants such as *Clitoria ternatea*, or the beggar weeds (*Desmodium* spp.), would seem to be an excellent crop for occupying the land for a short period, and providing material for ensilage or hay for fodder in the drier periods of the year.

It is to be borne in mind that Natal grass is not a perennial, renewing its growth year after year from underground root-stocks, but that it can easily be sown in different fields year after year by utilizing the plentiful seeds which it produces.

MARKET REPORTS.

London.—The West India Committee Circular, May 13.

Balata—Venezuelan Block, no quotations ; West Indian Sheet 4*s.* 4*d.*, spot, 4*s.* 7*d*
Beeswax—No quotations.
Cacao—Trinidad, 144*s.* to 150*s.* Grenada, 126*s.* to 130*s.* and St. Lucia, 121*s.* 6*d.* to 137*s.* 6*d.* Dominica, 120*s.* to 130*s.* Jamaica, No quotations.
Copra—£59
Honey—.80*s* to 150*s.*
Lime Juice—Raw, No quotaions Concentrated, no quotations.
Pimento—5¾*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T. S. Garraway & Co., June 8.

Arrowroot—$9·00 per 100 ℔. duty paid.
Cacao—Lottings at 24c.
Coco-nuts—$52·00 husked nuts.
Hay—Market bare.
Onions—Sales at $3·87.
Peas, Split—No quotations; Canada, Market bare.
Potatoes—$8·00.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, April 20.
Bay Oil—27*s.* to 32*s.*
Lime Oil—7*s.* 9*d.* to 8*s.* for West Indian distilled, and 16*s.* to 25*s.* for hand-pressed.
Orange Oil—West Indian, 35*s.*

Trinidad.—Messrs Gordon, Grant & Co., May 5.
Cacao—Venezuelan, $25·70 to $26·00 ; Trinidad, $24 00. to $24·50.
Coco-nut Oil—$2·35 per gallon.
Coffee—Venezuelan, $5·50 per famga in bond.
Copra—10½c. per ℔.
Dhal—No quotations
Onions—$15·00 per 100 ℔. Light stocks.
Peas, Split—$10·00 per bag.
Potatoes—English, $8·00 per 100 ℔.
Rice—Yellow, $13·00 to $13·50. White, $14·00 per bag.
Sugar—No quotations.

New York.—Messrs. Huth, Gillespie & Co., Inc. May 26.
Cacao—Caracas, 19c. to 19½c.; Grenada, 18c. to 18½c. ; Trinidad, 18¼c. to 18½c. ; Jamaica, 13½c. to 14½c.
Coco-nuts—Jamaica selects, $57·00 per M; Trinidad $53·00 per M; culls, Jamaica, $36·00 ; Trinidad $35·00 per M.
Copra—9¼c. to 9½c.
Coffee—Jamaica, 17½c. to 24c. per ℔.
Ginger—38c. to 42c. per ℔.
Goat Skins—Jamaica $1·20; Antigua and Barbados, $1·15 St. Thomas and St. Kitts $1·15
Grape Fruit—Jamaica, $4·00 to $4·75.
Limes—No Market.
Mace—36c. to 38c.
Nutmegs—26c.
Oranges—$3·50 to $4 00.
Pimento—8¼c. per ℔.
Sugar—Centrifugals, 96°, 21½c.; Muscovados, 89°, 19¾c.; c. & f., Molasses, 89°, 19¾c.

Special Selected Sea Island Cotton Seed

— FOR —

PLANTING PURPOSES.

We can supply you with the above, selected from Seed grown at the Government Industrial Schools, and the Lunatic Asylum Farm, under the supervision of the Agricultural Department. Lint from this Seed has been highly reported on by the Spinners in England.

WE SOLICIT YOUR ORDERS. ☚

The Barbados Co-operative Cotton Factory, Ltd.

WHITE PARK.
May 15, 1920.

AGENTS FOR PUBLICATIONS OF THE IMPERIAL DEPARTMENT.

London: Messrs. Dulau & Co., Ltd., 34-36, Margaret Street, Cavendish Square, W.
West India Committee, 15, Seething Lane.
Barbados : Advocate Co., Ltd., Broad Street, Bridgetown.
Jamaica : The Educational Supply Company, 16, King Street, Kingston.
British Guiana : The Argosy Co., Ltd., Georgetown.
Trinidad: Messrs. Muir-Marshall & Co., Port-of-Spain.
Tobago: Mr. C. L. Plagemann, Scarborough.
Bahamas: Mr. N. D Sands, Board of Agriculture, Nassau.
Grenada: Messrs. Thos. Lawlor & Co., St. George
St. Vincent: Mr. Floris Simmons, Experiment Station.
St. Lucia: Mr. R. W. Niles, Botanic Station.
Dominica: Mr. J. R. H. Bridgewater, Roseau
Montserrat: Mr. W. Robson, Botanic Station
Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre.
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 801, Yonge Street, Toronto

STORING SEED-CORN FOR PLANTING.

In the Report on the Agricultural Department, St Vincent, for the year 1917-18, excellent results in drying and storing corn and beans for food purposes in that island were described. In relation to a kindred subject, the following paragraphs from the Report on the Agricultural Department, Grenada, for the year 1918 19, should be of general interest.

In connexion with the Native Food Crops Campaign in Grenada, it was found advisable to obtain large quantities of seed corn for distribution purposes. The subjoined is a résumè of the storing of the seed.

It must be remembered that corn kept for sowing purposes, and that stored for food purposes, cannot be subjected to the same treatment. In the latter case the corn is dried at a considerable temperature, the process destroying to a certain extent its germinating power. In the former case the object is to preserve this power, at the same time eliminating as much moisture from the seed as possible without destroying its vitality.

In October 1916 the Superintendent of Agriculture, the late Mr. J. C. Moore, advised that an attempt be made to store locally grown corn so as to provide a supply of seed for general distribution in May and June 1917. Accordingly in November, 60 barrels of corn selected from peasants' crops were stored in a room at the Botanic Station. This room is constructed mainly of wood with a shingled roof, having a capacity of 3,120 cubit feet, and is well ventilated, the windows and ventilator openings being, however, screened with ½-inch mesh wire netting.

The ears of corn, tied together in pairs by one or two of the segments of the husk left on for the purpose, were hung across racks made of 6-inch boards placed edgeways in tiers, spaced so as to insure free circulation of air throughout them, and to facilitate inspection, the total length of the racks being 426 feet. This afforded ample space, as it was calculated that 5 feet of racks could approximately hold the ears contained in a barrel, when the ears were hung three or four deep across them.

Windows and ventilators were kept fully open, except at night and during actual rainfall. A few weevils were noticed on the corn immediately after hanging, having probably obtained a lodgment there before the purchase of the corn. The only fumigation effected at this stage was by the fumes of a smouldering wood-fire for about six hours at a time, on three occasions at intervals of two weeks.

Shelling began on January 5, 1917. After having been shelled, the corn was 'sunned' for two days, sifted in order to remove dust and chaff, fumigated with hydrogen cyanide for sixteen hours, and immediately stored in a bin. Owing to limited facilities this process took some time, being only completed on February 1.

The storage bin, 7½ feet high and 4 feet square, was constructed of boards closely fitted, one-half of the top being fitted with a movable cover. The inside of the bin was lined with roofing paper tacked on with overlapping edges, and the outside tarred to secure tight joints. The bin was provided with a flue suitably perforated, running from the bottom of one side half-way across the floor, then rising vertically through the centre of the bin to 18 inches from the top. The lower portion of the flue was made large enough to hold a gas generator, and fitted with a tight door. The cyanide fumes were thus enabled to penetrate thoroughly the stored corn.

As the corn was put into the bin, muslin bags, each containing 3 oz. of crude flaked naphthalene, were distributed at regular intervals throughout the mass. This did not seem to be efficacious in warding off insect attacks.

Fumigations of cyanide were applied on February 13 and 23 and March 8. Two further fumigations of carbon bisulphide were applied on March 16 and on May 15. When the bin was emptied on May 23, a large number of weevils were found at the bottom. Had the bin been thoroughly air-tight, the effect of the fumigations would doubtless have been more complete. However, there was no indication of mildew observed.

As a result of this experiment, over 4,000 lb. of seed-corn, harvested in October 1916, were distributed for planting purposes in May and June 1917 in Grenada and Carriacou. The seed was clean and bright in appearance, entirely free from mildew, practically free from weevils and moths, and possessed an indicated viability of 87 per cent.

One piece of useful information supplied by this successful experiment is, that hydrocyanic acid gas can safely be used in fumigating thoroughly dried seed-corn, without seriously affecting its vitality.

THE RESEARCH ASSOCIATIONS

At a conference of Research Associations held in London on May 14, 1920, Dr. A. W. Crossley gave an account of the constitution and methods of the British Cotton Industry Research Association, of which he is Director. As the work of this Association bears upon the cotton industry of the West Indies, the following review of Dr. Crossley's account is reproduced from *Nature*, May 1920.

The British Cotton Industry Research Association embraces every activity that contributes to the production and utilization of cotton, and represents more than 95 per cent. of the firms engaged in the industry. Among its members are some of the Labour leaders, and these take the keenest interest in its work. It aims to obtain, in the first place, more exact knowledge of the chemical and physical properties of the fibre, and the scientific facts which lie at the base of the processes employed; for it is considered that it is only in this way that the true solution of the problems which present themselves can be assured.

It appeared to be generally agreed that one of the most important conditions of the success of the movement was its close association with the universities and colleges where scientific research has hitherto been mainly carried out. It is to them that research associations and the research departments of private firms must look for their supply of science workers, and it is obviously important that those who are engaged in preparing men and women for the task of industrial research should be acquainted with the lines on which it is carried on.

The question of the publication of the results of industrial research presents serious difficulties. As Dr. Crossley remarked, those employed upon it must keep in close touch with those engaged in pure research, on whose conclusions their work is based, but they cannot be always taking without giving something in return. He urged that a large proportion of the work carried out should ultimately be published, even if for commercial reasons it had to be held back for several years; and Dr. Lawrence Balls reminded the conference that the stimulus of the prospect of future publication was required to secure the accurate record of the data obtained in the course of a research.

SUGAR INDUSTRY.

CANE EXPERIMENTS IN ST. CROIX

(*Concluded.*)

In the previous issue of the *Agricultural News*, some experiments on sugar-cane cultivation carried out by Mr. Eduard Gedde, at the Slob Experiment Station, St. Croix, were described. In the present article attention is drawn to important results obtained at the same station in experiments made to determine the relative value of planting cane on flat or banked land.

A reason frequently given for the prevalent practice in most of the smaller West Indian islands of planting between banks, is that such a system tends to conserve moisture in the soil, and, on the other hand, tends to prevent erosion of the fields by heavy downpours of rain. During the year 1919, the rainfall in St. Croix was considerably above the average, and rather abnormally distributed. In the month of April, for instance, which is usually one of the driest months, there was a very heavy rainfall, causing on the 27th and 28th of the month a considerable wash in the cane fields. Mr. Gedde, however, remarks that fields planted on the flat did not suffer any more than banked fields. In September also there were heavy rains, and it was observed that tops planted on the flat in October sprouted well, while the germination of those planted on banked land was very poor.

In experiments conducted in previous years on the two methods of cultivation, the plots, whether cultivated on the flat or banked, had always been all carefully cultivated beforehand. In the present experiment the point was to investigate the difference, both in the yield and in the cost of the cultivation, between plots planted on well treated soil on the flat, and those banked up, as is a common custom, immediately after cutting tops for plants from sprouts resulting from first ratoons, such plots having received no weeding in the interval between reaping and planting.

Twelve plots of equal dimensions were laid out in a field from which a crop of plant canes and one of first ratoons had been previously reaped. On the six flat plots immediately after the canes were reaped, the trash was burnt, and the land ploughed; subsequently they were cultivated continuously, so as to obtain a fine surface dust mulch. At the beginning of September manure was spread over the whole surface, and ploughed in to a depth of 6 inches. On the other six plots the ratoons, after having been cut were allowed to sprout so as to provide tops for planting. The flat plots were planted on October 22, 1918, with tops obtained from the other six plots. On these, as soon as the plant tops had been cut, the and trash was hauled up in rows; manure spread over the whole, surface, as was done on the flat; they were then ploughed and banked, and planted on November 21, 1918. The flat plots were reaped on January 27, 1920, and the banked plots reaped just one month later, in order that the time of growth should be the same in both cases. The following table gives the yield of each plot.

It will be seen from the calculated amount of probable error that the results are consistent with a very high probability of accuracy:—

Flat Land.		Banked Land.	
No. of plot.	Estimated yield per acre in tons.	No. of plot.	Estimated yield per acre in tons.
1.	37·8	1.	27·8
2.	41·1	2.	28·1
3.	39·0	3.	26·0
4.	39 1	4.	28·8
5.	37·9	5.	29 2
6.	41.2	6.	25 6
Average	39·3	Average	27·6
Probable error	± 1·00	Probable error	± ·99
Per cent.	2 55	Per cent·	3·58

From the above table it will be seen that 11·7 tons more per acre or 42·4 per cent. were obtained from planting on the flat than from planting between banks.

With regard to the comparative cost of cultivation, the following table shows a very remarkable advantage from planting on the flat:—

	$	$
Ploughing	4·11	6·40
Harrowing	3·16	
Removing cane stools	1·50	
Hauling trash		2·00
Carrying and spreading manure	3·34	3·66
Cutting for planting	·28	
Banking		4·47
Planting	1·35	1·35
Supplying	·45	1·36
Machinery	2·25	1·36
Weeding	4·05	25 21
Total	20·49	45·81

It will be observed that the cost of cultivation was $25·32 more per acre on the banked land that on the flat, in fact more than double. The chief expense in the latter case was for weeding, in which item the contrast is very marked, as is also that in the expense incurred for supplying Mr. Gedde remarks that this latter result agrees with former experiments, which demonstrated that cane tops grew better when planted on well cultivated flat land than when planted between banks.

As a corollary to these plot experiments, five fields on an estate belonging to the same company as the Experiment Station were cultivated on the flat under the supervision of Mr. Gedde. It seems a pity that there were no results stated as to banked fields under similar conditions. The average yield, however, of the five fields so planted was slightly over 33 tons per acre, one of the fields giving as high a return as 40 tons.

Some experiments recorded by Mr. Gedde on the effects on flat land or on banked land of pen manure stored in different ways do not seem to be conclusive with regard to the relative value of the manner of storing the manure, but there is a striking difference in favour of land planted flat as compared with banked land, there being a gain of 20·2 per cent. in plant canes, and 10·2 per cent. in first ratoons, being a mean of 15·7 per cent.

CUBAN AND HAWAIIAN METHODS OF CANE PLANTING AND REAPING COMPARED.

In the *International Sugar Journal*, April, 1920, a report of Mr. Noël Deerr, presented to the Hawaiian Sugar Planters' Association on the differences in the methods pursued in the sugar industries of Cuba and Hawaii, is reproduced. The following paragraphs from Mr. Deerr's report will be interesting to sugar planters generally.

The Cuban sugar industry is essentially one of extensive methods as opposed to the intensive routine followed in Hawaii. Its production of cheap cane depends on the planting of large areas to which is given, especially in the more recently developed lands of eastern Cuba, a minimum of cultivation, and for which no expenses are incurred for either irrigation or manuring. The result is a small return of cane, which does not average over 20 short tons per acre, but which is at the same time produced for a very small cost per ton of cane. It hence follows that Cuban practice affords high profits per ton of cane or per ton of sugar, simultaneously with small profit per acre. Hawaiian practice, on the other hand, aims at obtaining the maximum of profit per acre, and at the same time decreasing the cost of production per lb.

A second difference is to be found in the relation between producers and manufacturers. Most of the cane grown in Cuba is raised by planters who sell the produce to mill owners for the value of so much sugar, expressed as a percentage basis on cane; this percentage lies between the limits of $4\frac{1}{2}$ per cent. and $7\frac{1}{2}$ per cent. It is easy to see that under such conditions the manufacturer often will, and indeed generally does, make large profits when he works up the maximum possible quantity of cane at a moderate efficiency.

In Hawaii, however, the quantity of raw material available is fixed, and already the return of cane per acre does not seem capable of further increase, so that in order to augment his profits, the Hawaiian manufacturer is confined to expressing as much sugar from the cane as is economical, having due regard to the prevailing prices of sugar, fuel, and supplies. This condition, equally with that in the field, tends to increase the cost of production in Hawaii, while still yielding the maximum of profit, and finally it may be said that the comparison between Cuba and Hawaii clearly shows that the low cost of production does not necessarily imply efficiency, but rather the reverse.

Turning now to a comparison of the methods of harvesting, it appears that in Cuba, the cane, after cutting, is loaded into bullock carts, the capacity of which is 7,500 lb., and which are drawn by two or more yoke of oxen. The cane is cut into 6-foot lengths, and is carefully packed into the carts, in which are placed chain slings, serving, with the assistance of a derrick, to transfer the load en masse to 30-ton standard gauge railroad cars. A well-loaded car will hold 45,000 lb. of cane, and a cane train will be made up of a maximum of thirty cars. The distance hauled by the oxen seldom exceeds a mile, but the railroad haul to the central may be as much as 50 miles, and, on an average, is much longer than anything that obtains in the Hawaiian Islands. The great areas over which the Cuban properties extend necessitate a standard gauge track, and the transport would not be economically possible with the narrow gauge roads sufficient for the more concentrated industry in Hawaii.

With the great extension of the cane areas, combined with the lack of control following on the colono system, it results that a much longer time obtains between cutlass and mills in Cuba than is the case in Hawaii. In eastern Cuba, at any rate, it is not uncommon for the mills to operate on cane at least a week old, and it seems likely that it would not be far wrong to put the average age of the cane worked up as much as from seventy-two to ninety-six hours. It is quite easy to trace the effects of this long storage in the milling results, and here lies one of the economic losses, and one that is not generally recognized as such.

In Cuba the cost of harvesting the crop frequently amounts to 60 per cent. of the total cost of production. Under harvesting is included cutting, loading, hauling and transportation. This particularly refers to eastern Cuba, with cane sold at 5 per cent.

With regard to unloading the canes at the mill, the endless belt rakes and reciprocating mechanical fingers used in Hawaii to unload cane have never been used in Cuba. The method now almost generally followed there is the dump. The cars are built so that their sides may swing outwards. Hence, on inclining the car, the load gravitates into a hopper or into a carrier. To effect the discharge, a tilting platform is located alongside the hopper or carrier. Side or end dumps are equally in use, and the power used to operate the tilting platform is usually hydraulic. The unloading of cane by means similar to that used for transferring it from carts to cars is now little used.

With regard to milling, capacity and not extraction is the object of the Cuban mill. Whereas Hawaiian practice regards the milling plant as a means of extracting sugar, that of Cuba looks upon it as a means of grinding cane. This point of view follows from the economic differences in cultivation alluded to above. The high extraction reached in Hawaii is never obtained or even aimed at in Cuba.

New Potash Supply.—From a notice in the *West India Committee Circular*, April 29, 1920, it appears that an important new source of supply of potash available for agricultural purposes is about to be opened. It is stated that a well-known Swedish company has commenced to manufacture potash on a large scale by its extraction as a by-product in the production of cement from potassic minerals and rocks, such as felspar, granite, gneiss, etc.

About 56 lb. of potash are expected to be produced along with each ton of cement, and as a cement factory of normal size has an annual production of 50,000 tons, this will mean a possible total per annum of 1,000 tons of pure potash capable of being used as an artificial manure from each such factory.

DEPARTMENT NEWS.

Sir Francis Watts, K.C.M.G., Imperial Commissioner of Agriculture for the West Indies, left Barbados on the R.M.S. 'Chaudiere' on June 23 for St. Vincent on official business. The Commissioner is expected to return in a fortnight's time.

COTTON EXPORTS FROM THE BRITISH WEST INDIES.

The following figures show the quantity and estimated value of Sea Island cotton exported from the West Indies for the quarter ended March 31, 1920:—

Colony.	Quantity in lb.	Estimated value. £.
Grenada	nil	nil
St. Vincent	111,035	22,207
Barbados	21,517	1,505
Montserrat	554,975	168,700
Antigua	12,750	3,506
St. Kitts	260,286	61,818
Nevis	230,743	54,801
Anguilla	39,220	9,315
Trinidad	nil	nil
Virgin Islands	25,425	5,810
Total.	1,255,951 lb.	£ 327,662

Besides the above, Barbados exported 1,200 lb. cotton waste, of an estimated value of £30, and the Virgin Islands 480 lb. stained cotton, valued at £52, and 2,702 lb. native, valued at £347.

EDUCATION IN THE USE OF AGRICULTURAL MACHINERY.

The use of machinery in agricultural operations is steadily increasing in those countries where the need for increased production and more intensive agriculture is felt; and it has been pointed out, as appears from the abstract below, that for the best results to be obtained, the persons to be employed in the operating of such agricultural machinery should be able to obtain requisite instruction. This subject has recently been receiving consideration in England by the Departmental Committee on Agricultural Machinery, and reference thereto, appearing in the *Journal of the Ministry of Agriculture*, May 1920, is reproduced below, as of general interest, especially since the use of tractors is being widely extended in tropical countries also.

It is now generally recognized that education must play an important part in stimulating the use of improved machinery in agriculture. In evidence given before the Departmental Committee on Agricultural Machinery, this opinion was expressed by nearly all the witnesses. The raising of the standard of general education is likely to stimulate the interest and quicken the apprehension of all classes of workers in tasks other than dull routine; and this in itself will lead to a better and more instructed use of agricultural machinery, and a broader outlook upon its possibilities. Beyond this, however, direct instruction in the principles and use of machinery is required by all classes of the agricultural community.

At present some measure of instruction in agricultural engineering or allied subjects is provided at agricultural colleges and kindred institutions, and by local authorities, either through farm institutes or by means of extension lectures. The opinion of a number of well-qualified witnesses who appeared before the Committee was, however, that the present facilities were inadequate. It is urged that the subject of agricultural machinery should occupy a more prominent place in the curricula of agricultural colleges and farm institutes, and that in the case of the former, there should be attached to the staff at least one specialist whose whole time would be devoted to the subject, and who would be available for instruction and advisory work. Further, there should be available at each institution, besides the machinery and implements used on the farm, a well-equipped machinery workshop, and an exhibition of the principal types of machines and implements on the market.

The facilities hitherto given have been available chiefly for those who would later farm on a fairly large scale, or who would direct farming operations in some capacity or other. Less provision appears to have been made for the instruction of smaller farmers and of labourers in the principles and use of agricultural machinery; and the problem has probably been found to present greater difficulties. The Committee has come to the conclusion, after sounding the views of the witnesses best qualified to speak on this subject, that either within the continuation classes proposed under the new Education Act, or outside them, some instruction in the principles of mechanics and in their practical application to agriculture might usefully be given to youths above the age of fourteen; it is believed that in this way the interest of the man in his task would be increased, and that he would become a more intelligent and a more efficient worker. By means of short courses and extension lectures the needs of farmers and specialized workers who require more than a general knowledge of agricultural machinery could probably be met; and the Committee recommends that local authorities should be encouraged to provide instruction in such subjects as tractor driving and mechanics, and the principle of the internal combustion engine.

It was suggested that short courses of instruction should be provided for farm workers in regard to particular machines, such as the tractor and binder, and one witness referred to a practice of Canadian firms to give free short courses in the use and repair of tractors. Doubt is expressed as to the possibility of courses on similar lines, conducted by the local authority, being organized in England, but the Committee believes that the experiment would be worth trying, and has little doubt that the co-operation of at least some firms might be counted upon.

One difficulty likely to be experienced in giving effect to these proposals, it is pointed out, would be the provision of efficient instructors, and in the first instance it would probably be impossible to obtain the services of a sufficient number of men with the combination of theoretical and workshop training which the Committee would regard as the ideal. The type of instructor to be aimed at is a combination of the engineer and the agriculturist; instruction in engineering, including workshop practice, should form the basis of his training, and should be followed by instruction in agriculture. It is hoped that at a later stage the proposed Research Institute in Agricultural Machinery will be in a position to take some part, at least, in training of this character, although care must be exercised to prevent teaching from encroaching unduly on the research side of the Institute.

SANDALWOOD OIL.

Indian sandalwood is the heartwood of an evergreen tree (*Santalum album*), the growth of which is practically limited to parts of Southern India, chiefly Mysore and Coorg, and two districts in the Madras Presidency.

Long before European voyagers reached India by sea, there was a considerable commerce in sandalwood within the bounds of India itself, as had probably been the case from very early times, as sandalwood is mentioned in ancient Sanskrit literature.

In an article on sandalwood and its oil, which appeared in the *Perfumery and Essential Oil Record*, April 1920, it is stated that the heartwood is the equivalent to about one-third of the felled tree in weight. This wood is employed in the manufacture of small ornamental boxes and picture frames, and for carved work in general. As is well known, it is held in high esteem on account of its fragrant odour. Among the Hindus the wood is employed for religious rites and ceremonies. They smear sandal paste on their foreheads and the upper parts of their bodies, and, by those who can afford it, billets of the wood are burned in the cremation of their dead. The Parsees also make use of sandalwood in their temple fires.

The oil content of the heartwood varies from 5 to 7 per cent. Sandalwood oil has valuable medicinal properties, and is recognized in the British Pharmacopoeia ; it is also used considerably in perfumery, and in the manufacture of superior toilet soaps.

In Mysore and Coorg all the sandalwood trees belong to the State, while in Madras, though private ownership obtains, production is almost a monopoly of the Government forest reserves. All wood collected during the year in the three Provinces was formerly sold at public auction, the average quantity thus disposed of ranging from 2,500 to 3,000 tons yearly.

The article alluded to above states that the extraction of oil by crude methods is one of the oldest indigenous industries in India, and that costly attars and perfumery are still produced by primitive and wasteful processes. Distillation was long prohibited in Mysore, but the collapse of the demand for the wood after the outbreak of the war led to experiments being made for the distillation of the oil, and in 1916 a factory was opened in Bangalore under State management with a producing capacity of 2,000lb. of oil a month. This project was started at a most favourable time, when the price of sandalwood oil in London was increasing at every sale ; the price was 31*s.* per lb. in 1916, andr ose to 52*s.* 6*d.* by the middle of July 1918.

Distillation on a large scale in India carries with it the practical advantage of a considerable reduction in the cost of freight, seeing that a ton of wood yields, on an average, 100 lb. of oil, the weight of which when packed is only one-tenth of the wood itself, and the space occupied still less in proportion. Since its erection the Bangalore factory has been enlarged to a monthly capacity of 20,000 lb., while a second factory with an ultimate capacity of 20,000 lb. per month started work in August 1917 in Mysore. Up to December 31, 1918, these two factories had together dealt with 2,113 tons of sandalwood, yielding 212,371 lb. of oil. In 1917-18 the sale of oil brought in £183,300 to the Mysore State. The total value of oil exported in the year 1918-19 from India was £227,563, and that of the wood exported £10,529.

Before the war 43·4 per cent. of the exports went to Germany, the United Kingdom taking 21·7 per cent., and America 15·5 per cent. At present by far the largest amount of oil is exported to the United Kingdom, while a good market for the product has recently been developed in Japan.

A point of importance in connexion with the development of the sandalwood oil industry by the Mysore Government, is that every consignment of sandalwood oil from the Government factories is accompanied by a certificate of quality from the Indian Institute of Science, Bangalore, thus ensuring the shipment of only the highest grade of oil.

CANE ARROWING, AND THE RAISING OF SEEDLINGS.

The following article over the well-known initials of Dr. C. A. Barber, is reproduced in great part from the *International Sugar Journal*, April 1920 :—

The laws governing the flowering of the sugar-cane are by no means fully worked out, but a good many observations have from time to time been made, and we are, it is hoped, beginning to see light. The cane breeding Station at Coimbatore in South India is peculiarly dependent on the control of this part of the growth of the sugar-cane, and it has been very closely studied there. Although it is probable that the subject may have to be examined in each place separately, it is thought that the experience gained may be of use where less concentrated attention can be paid to it.

Flowering of the cane has been proved to vary in India with the latitude, even in the same varieties ; the annual rainfall and its distribution have a marked influence ; the kind of soil and its treatment also cause it to vary, while the different kinds of canes flower at different times, and have a very different flowering capacity. Individual cane varieties or whole groups of canes do not flower, or merely make the first preparations for so doing ; others go so far as to protrude unhealthy or malformed arrows with never a fertile flower on them ; others again make a fine show of fine plumy arrows in great abundance. but these turn out to be sterile, either completely so, or in the male or female portions of the flower only ; some produce great masses of seedlings which have little vitality, and, after a brief period of vigorous growth, die away in thousands ; many, lastly, can be relied on to yield a good crop of seedlings which can be guaranteed to grow to maturity. As a result of a series of observation and experiments, it has been found possible in the Coimbatore farm to exercise a certain amount of control on the arrowing of the canes grown there, and, within the somewhat narrow limits of the arrowing season, to alter slightly the protrusion of the inflorescences of the individual varieties, and thus cause them to synchronize with those of others with which it is desired to cross them.

As a result of the study of these phenomena during the past eight or nine years, it is possible to form a fairly accurate judgment of the probable fertility of any arrow which may be received, both as to its male and female organs, and a statement could be made as to the likelihood of the plant from which it had been cut being useful or not in the production of seedlings. It could also be stated what chance there would be of using the arrows of such a plant in the successful crossing work which has now become the routine practice of the station. If the parent or parents are known, it would be possible to forecast the average sucrose content of the seedlings, whether the arrow had been self-fertilized or crossed, and a general statement could usually be added as to the average vitality of the seedlings, and their susceptibility to any of the prevailing diseases.

These claims may appear to be somewhat extravagant, considering the somewhat pessimistic notices which have from time to time been issued by workers in this field of enquiry. But it is only fair to note that most of these workers have been officers otherwise very fully employed. It is somewhat unfortunate that, while whole-time plant-breeding experts have been considered necessary for other crops, the raising of sugar-cane seedlings has been considered so easy that it can be done by any one. But, while that is in the main true, it does not mean that their study is not worth a certain amount of concentration, much more indeed than can be given them by general officers.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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†Provided by the Imperial Department of Scientific and Industrial Research.

Agricultural News

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NOTES AND COMMENTS.

Conents of present issue.

The social, educational, and scientific value of botanic gardens, forms the subject of the editorial of this issue.

Under Insect Notes, on page 202, some description is given of the borer as a pest to the banana cultivation in Fiji.

The black spot and bark rot of cacao, two diseases apparently caused by the same parasitic fungus, are dealt with under Plant Diseases, on page 206.

Experiments undertaken in St. Croix on the cultivation of sugar-cane are again noted on page 196.

Some interesting notes by Dr. C. A. Barber on cane arrowing and the raising of seedlings are reproduced on page 199.

Raccoons.

In the *Agricultural News*, January 24, 1920, there was an article drawing attention to the question as to whether the raccoon was extinct in Barbados or not. The Imperial Commissioner of Agriculture expressed a desire to obtain, if possible, a specimen to be forwarded to a Natural History Museum in the United States from which a desire had been expressed to obtain one, in order to determine definitely whether the raccoon, which was formerly plentiful in Barbados was of the same species (*Procyon lotor*) as is found on the Continent of North America.

The question as to the present existence of the raccoon in Barbados has been definitely settled by the fact that a living specimen, captured in a mongoose trap, was brought to the Office of the Imperial Department a couple of weeks ago. It was purchased, and has been forwarded alive in a suitable cage to the Museum in the United States referred to above, where it is hoped it will arrive safely.

The nocturnal habits of the raccoon were very noticeable during the few days it remained in captivity at this Office. Although supplied with fruit, bread, and water during the day, it remained with its head poked into the corner of its box, apparently asleep all through the hours of daylight, without touching any of the food supplied to it. On the next morning, however, its food had disappeared, although the little beast was again apparently asleep in its corner.

Growth of Plants Made Visible.

Much interest has lately been taken by scientific men in the experiments of Sir Jagadis Bose, the distinguished Indian scientist, on movements in plants. In a notice of a lecture delivered by him at the University of London Club, *Nature*, May 6, 1920, says that he has applied the methods of instrumental physics to the study of tropic plant movements, and, beginning with methods which magnified the growth one hundred times, has finally, with his high magnification crescograph, reached magnification of more than ten million. This instrument uses the principle of a fine magnetized lever affecting a magnetic needle, and so demonstrating growth by the movement of an attached mirror. By this method very delicate growth responses of the plant can be shown, and its relative sensitivness under different conditions compared.

Sir Jagadis Bose's crescograph is so remarkably sensitive that doubt has been expressed as to the reality of its indications with regard to plant growth, and the suggestion has been made that the effects shown by it were due to physical changes. A demonstration, however, at University College, London, before a number of leading English scientists, led them to state in *The Times* of May 4: 'We are satisfied that the growth of plant tissues is correctly recorded by this instrument, and at a magnification of from one to ten million times.'

Research Work on Sponge in the British West Indies.

On the recommendation of the Colonial Research Committee, Viscount Milner, Secretary of State for the Colonies, appointed in September last year Mr. L. R. Crawshay as a Research Officer for the investigation of sponge in the British West Indies, and particularly in the Bahamas.

In the Secretary of State's despatch to the Imperial Commissioner of Agriculture for the West Indies, informing him of this appointment, it is stated that Mr. Crawshay has been instructed to keep in touch with him.

After having first paid a visit to Florida, in order to observe the sponge farms on that coast, Mr. Crawshay proceeded to Nassau, which will be his headquarters. He intends however, later on, to pay a visit, if possible, to some of the Leeward and Windward Islands.

Research work on the possibilities of extending the sponge industry in these islands, and of methods of cultivating varieties of sponge of commercial value, is certain to be important, scientifically as well as economically.

The Value of Nitrate of Soda in Crop Production.

In *Bulletin 323* of the New Jersey Agricultural Experiment Station, the results are summarized of more than twenty years experimental work in which nitrate of soda as a source of nitrogen has had a prominent place. The results seem to point to the conclusion that nitrate of soda, used at the rate of from 100 to 160 lb. per acre, on soil of medium quality, well supplied also with phosphoric acid and potash, almost invariably increases the yield of general farm crops, potatoes, and other vegetables, and that this increase, supposing that nitrate of soda can be obtained at a fair price, is shown to be sufficient to give a fair profit over the cost of the nitrate. The conclusion also seems to be fairly drawn that, unit for unit of nitrogen, the nitrate usually gives a greater increase than sulphate of ammonia or organic sources of nitrogen, such as dried blood. Net increases in value, varying from a few dollars to more than $150·00 per acre, have been noted, depending on the crop and the season.

One-Horse Tractors.

There are constantly being originated new devices whereby the horse or the ox may be replaced for agricultural purposes by motor-driven machines. One of the recent developments in this direction has been the production of a small, handy tractor for which it is claimed that it will do all the work ordinarily done by one horse, such as cultivating, light harrowing and ploughing, mowing and all work in gardens; and besides that, it may be employed in many places where a horse cannot be used, and wherethe ordinary large and powerful, but cumbersome tractor is not adapted for the work.

Such a machine appears to be the Beeman one-horse tractor, which is described as weighing about 550 lb., and being 86 inches long over all, and only 17¼ inches wide. The light weight and small dimensions, together with a powerful and single cylinder, 4 h.p water-cooled motor, enables it to go anywhere, it is stated, and to do the work of one horse. In addition to handling all ordinary farming implements of suitable size, it may be used independently as a source of power for the operation of pumps, corn mills, and other machines. From a communication recently received by this Department, it appears that the Automotive Products Corporation, Woolworth Building, New York, controls the export of these machines, which are manufactured by the Beeman Tractor Company., in Minneapolis.

Rats.

The *Journal of the Jamaica Agricultural Society*, March 1920, has a note on means of controlling rats, which seem to be a great pest in that island. In some parts of it, and on some crops, it is stated that they cause a loss of as much as one-third of the yield. The use of poisons, though possibly effective, is dangerous to human beings and to live stock; traps are only moderately effective. A preparation of red squill, a vegetable product, which although poisonous to rats is not so to human beings and domestic animals, has been used effectively in the United Kingdom. Trial of this is advised.

Another method which seems new, and worth trying at any rate, is the use of a preparation of bird lime placed over spots where rats frequent. This sticks to their feet and tails, and the rats roll to get rid of it, and so get worse coated, and at length cannot move. There they are found in the morning and killed. It is said that hundreds have been caught in one field in one night by this method. The journal states that a form of bird lime can be prepared from the sap of breadfruit, jackfruit, and various fig trees, which might be efficient for this purpose. It is probably worth experimenting with, for rats are a terrible nuisance in other islands besides Jamaica.

In Support of the Tropical Agricultural College.

At a meeting of the House of Assembly of Barbados on June 15, 1920, a message from His Excellency the Governor, with reference to the founding of an Agricultural College in the West Indies, was taken into consideration. After some discussion, an address to the Governor was passed, expressing the willingness of the House to contribute to the upkeep of the College to the extent of 1 per cent. of the annual revenue of the colony, provided that the other West Indian colonies contributed in the same ratio, and that the College be located in Trinidad.

INSECT NOTES.

THE BANANA BORER IN FIJI.

The following article on this subject is reproduced from the *Colonial Journal*, April 1920 :—

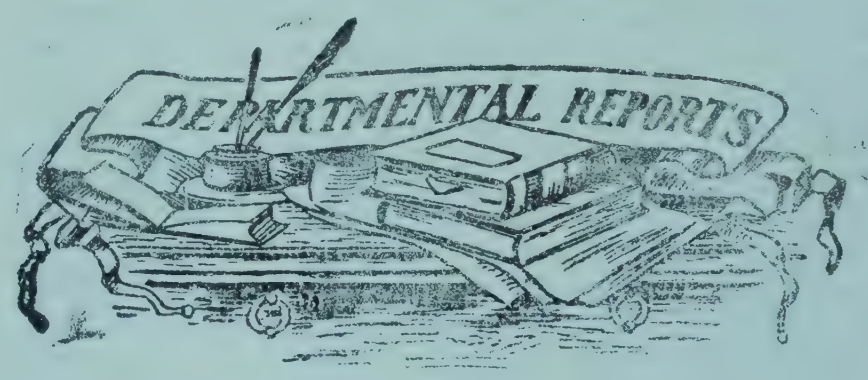
In Fiji the attacks of a borer (*Cosmopolites sordidus*) have been very bad. The Government entomologist is inclined to consider that many of the conditions in banana plantations, now thought to be the results of fungus diseases, are primarily due to attacks of the borer.

The banana plant consists of a bulb, from the apex of which leaves are given off in succession. Roots are produced on the lower part of the bulb. Water and mineral matter taken up by the roots must all pass through the bulb to reach the leaves, while the products of assimilation in the leaves must also pass through the bulb to reach the growing points where these products are required, such as growing roots, new leaves, and the fruit, In the case of a dicotyledonous plant, such as the mango or the orange, the products of assimilation in the leaves of a particular branch can reach the growing points directly. without even passing into the main stem Hence the bulb of a banana is a much more important part of the plant than the base of the trunk of a mango tree. Any mechanical injury to the bulb of a banana plant may reasonably be assumed to produce much greater effect on the plant than a similar injury at the base of a mango tree. The actual damage is the restriction in the supplies of food matter passing up through the root and from the green leaves to the fruit, roots, or other places where it is required. When the attacks are continued for a number of years the damage is not merely that due to the insects actually in the banana bulb during its life, but, owing to the restricted supplies of food matter year after year, the vitality of the plant has become affected, and each succeeding generation may be expected to show a greater loss of vitality. It is not difficult to imagine that plants, the leaves of which reach maturity and die before the fruit has matured, are merely showing the natural effect of loss of vitality. And it is reasonable to suppose that, if every borer could be killed, the plants would require years of careful cultivation before they could regain their original vigour. The beetle is general all over the colony. and is now exceedingly plentiful. Careful and thorough cultivation does not render the plants free from the pest, although it must naturally be assumed that under such conditions, they have a better chance of obtaining their proper supplies from the soil than when they have to struggle among a mass of weeds.

Evidence is required as to whether the beetle remains more or less in the one stool, or whether, when the adult beetles appear, they go wandering around before proceeding to the active work of propagating their species. When the vast number of beetles that must exist in a large cultivation is considered, it seems remarkable that so few are met with except in banana plants, which seems to indicate that the borer is inclined to adhere closely to its destructive work rather than to travel about.

Experiments have been carried out at Nassinu with traps made of pieces of banana bulbs laid on the ground among the banana plants. They are effective in attracting the bettles, but, unless the pieces are removed and destroyed at intervals of not more than twenty-one days, the beetles breed in them, and so instead of permitting a reduction to be made in their numbers, they would actually help to cause an increase. It is absolutely essential that no bananas be permitted to exist except under proper cultivation, and old worn out cultivations should be ploughed out, as they are good nurseries for the propagation of the pest

In 1911 a supply of a natural enemy of a banana borer was brought from Java. This enemy is a predaceous histerid beetle (*Plaesius javanus*), which in Java appears to exert a good check on this pest. The experiment of sending the beetles by post from Java to Fiji was tried. The first lot, sent in earth, all arrived dead. The use of sphagnum moss was then suggested, and out of twelve sent in this material eleven reached Fiji alive. In 1917 the Government of Jamaica asked if this insect could be sent there from Fiji. None could however be found, so it was finally arranged that beetles should be obtained for Jamaica direct from Java, and at the same time another supply was arranged for Fiji. A consignment arrived there from Java by post in September 1918, and, out of about 280 sent, 153 were alive. The method adopted for their liberation was to set them free in the early morning, three being placed in each of a number of banana stools infested with the borer. Assurances have been given by the owners of the cultivations in which the beetles were liberated that the bananas will be maintained for a number of years. A small number was liberated at Nassinu, and a few days after they were set free, an examination was made of some of the stools used, and one of the histerid beetles was found hiding behind one of the leaf stalks well above the soil. By liberating the beetles in well-grown and badly attacked stools, it is hoped that they will become established under natural conditions. A second consignment of these natural enemies of the banana borer has also arrived, and has given a fair return of live beetles



GRENADA: REPORT ON THE AGRICULTURAL DEPARTMENT, 1918-19.

The report for the year under review, the issue of which has been long delayed owing to the difficulty of getting printing work done quickly, contains many features of interest. The plot experiments with food crops, carried on at the Botanic Station, gives some valuable hints in this direction. This is particularly the case with the experiments with different varieties of yams, the more extensive cultivation of which is being encouraged by the Department, as a food crop of special value to the island.

In connexion with this subject of food crops it may be noticed that the campaign which was again carried out during the year under review for increase in the production of native food crops met with striking success. The report states that 'a very keen interest in cultivating food crops pervades the entire agricultural community, and a very satisfactory feature is the large number of special gardens being cultivated by the planters on the big estates.'

With regard to peasant agriculture, it is stated that : 'all varieties of local food-stuffs have been largely cultivated by peasants, and owing to this there has been no shortage or scarcity of products during the year under review.

Despite abnormal economic conditions brought abont by the war, the peasantry have not suffered very much from an agricultural point of view. More lands were brought under cultivation, thereby increasing the quantity of locally g own articles of diet. The scarcity of imported wheat flour led to good prices being obtained in the island for home grown substitutes.'

The Prize Holdings Competitions were again held during the year, which, although they entail considerable additonal work on the officers of the Agricultural Department, must be productive of great benefit to peasant proprietors from an educational point of view. The Land Settlement Scheme also seems to have continued to work satisfactorily.

A large section consists of the reproduction of the report of Mr. H. A. Ballou, Entomologist on the Staff of the Imperial Department of Agriculture, which he submitted to the Governor of the Windward Islands after a visit to Grenada chiefly for the purpose of investigating the attacks of thrips on cacao. This report also refers to other insect pests, and suggests methods of control.

The results of experiments conducted on stored corn for seed purposes are of great interest, and will be found reproduced on another page of this issue of the *Agricultural News*.

With regard to the chief crops of the island, it appears that the cacao crop, although falling considerably short of that of the previous year, was considered a fair one, 67,668 bags of 180 lb. each, having been produced, valued at £410,248 12*s*. 4*d* The spice crop, on the other hand, was the largest recorded in value, if not quite in quantity. The exports of nutmegs and mace amounted to 1,910,147 lb. valued at £65,505. 15*s*. 2*d*. or more than £30,000 above the value of the crop of the previous season. The lime crop showed some increase both in quantity and value over that of the previous season. The cotton crop also, which is chiefly produced in the Dependency of Carriacou, and most of which is of the Marie Galante type, showed a very large increase in the amount of lint exported, and also in the value of the crop as compared with that of the previous year.

It appears that under the new Agricultural Cadetship Scheme two cadets, after completing their studies at the Grenada Boys' School, began a course of training during the year under review at the Agricultural Department.

It may be mentioned that this report was the last to be compiled by the late Mr. J. C. Moore before retiring from the office of Superintendent of Agriculture. It bears testimony to the good work done by him and by the other officers of the Department in furtherance of the welfare of the agricultural community in Grenada.

THE JUJUBE.

On reading the title of this article, West Indians may ask, what is the jujube? It is the name by which the fruit called in the West Indies by the extreme ugly name of 'dunk' is known throughout the Eastern and Western tropics; hence its specific botanical name, *Zizyphus Jujuba*, which is derived from a West African appellation of the plant. It is time to make a protest against the perpetuation of ugly and inappropriate names in English for tropical fruits. This has successfully been done within the knowledge of the writer of this note in the case of one fruit at least. When he was a boy, no one in the British West Indies spoke of anything but 'alligator pear'; now that fruit is universally spoken of by the much more euphonious and appropriate name of 'avocado.'

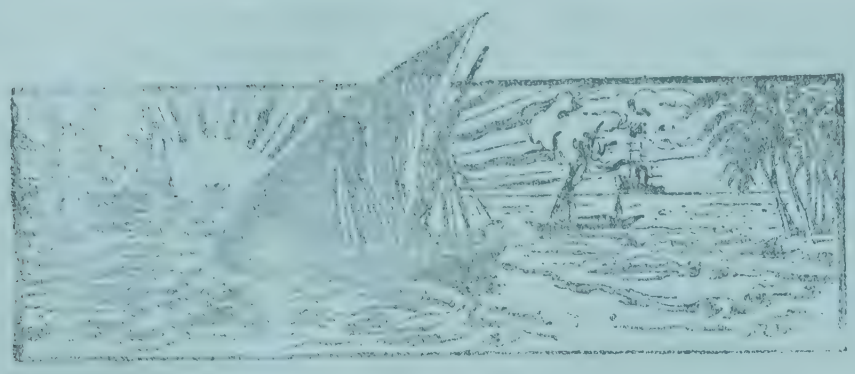
In previous issues of this Journal there have been references made to the propagation of superior varieties of the jujube, and also to the use of the fruit when preserved. In reference to this, Sir Gilbert Carter, K.C.M.G., whose interest in horticulture is well known, has contributed some notes of interest. Sir Gilbert in the first place points out that Linnaeus bestowed the name of *Rhamnus Lotus* on the jujube tree. Later botanists have, however, separated the genus *Zizyphus* from *Rhamnus*, still maintaining it under the order Rhamnaceae. In this genus there are included several species, the original one examined by Linnaeus being a native of the Mediterranean shores of Africa. This was traditionally the food of the Lotus-eaters whom Ulysses met 'in the land where it is always afternoon,' and is still both in Northern and Western Africa a valuable food plant.

Sir Gilbert Carter gives a reference to Mungo Park's travels in North-West Africa at the end of the eighteenth century, where it is stated that the natives of Gambia and Senegal collect the fruit of *Rhamnus Lotus* under the name of 'romberongs.' The following is an extract from Mungo Park's Travels: 'They are small farinaceous berries of a yellow colour and delicious taste, which the natives greatly esteem, and convert them into a sort of bread by exposing them some days to the sun, afterwards pounding them gently in a wooden mortar, until the farinaceous part of the berry is separated from the stone. This meal is then mixed with a little water, and formed into cakes which, when dried in the sun, resemble in colour and flavour the sweetest gingerbread. The stones are afterwards put in a vessel of water, and shaken about so as to separate the meal which may still adhere to them; this communicates a sweet and agreeable taste to the water, and, with the addition of a little pounded millet, forms a pleasant kind of gruel called 'fondi', which is the common breakfast in many parts of Ludumar during the months of February and March. The fruit is collected by spreading a cloth upon the ground, and beating the branches with a stick.'

Although, as will be shown below, *Zizyphus Lotus* is not the species introduced into the West Indies, but *Z. Jujuba*. the above description of the use made of the former species in Africa may afford hints of similar employment of the latter species in the West Indies.

With regard to the identity of the West Indian species, all the floras in which it is mentioned give the name as *Zizyphus Jujuba*, which is described as a small tree, whereas *Z. Lotus* is described as only a shrub of a few feet in height. The original habitat of *Z. Jujuba* is given in the Kew Index as India and Malaya, whence it has been introduced into many other tropical and sub-tropical regions.

In China this tree is extensively cultivated, and numerous varieties have been produced, the fruits of which vary in size from that of a cherry like the variety common in Barbados, to that of a hen's egg. The Bureau of Plant Industry of the United States Department of Agriculture has imported from China into the States a number of superior varieties from China, and the cultivation of them is extending in the Californian orchards. Dozens of varieties are described, but all are referred to the same species.. It would be a good thing if horticulturists in the West Indies could import from California or Florida grafting material of some of these superior varieties of jujube for propagation on stocks of the naturalized variety, which, as it exists at present, cannot be considered to be a very delicious fruit, although varieties differing very much in appearance and flavour exist in these islands.



GLEANINGS.

Ostriches, it is known, existed in Morocco since prehistoric times, and then entirely disappeared. Recently however, breeding experiments, with a view probably of establishing ostrich farms after the type of those in South Africa, have proved, it is stated, very satisfactory at two places, Meknes and Marrakech, where they have been carried out. (*Tropical Life*, April 1920.)

In the Report on the Agricultural Department, Grenada, for the year 1918-19, it is stated that from an experimental plot of land, $\frac{7}{10}$ acre in extent, thoroughly prepared and cultivated, crops were obtained which indicated that from an acre of land worked in a similar manner, a yield of 21,614 lb. of yams, 1,171 lb. of corn, and 442 lb. of dried beans may be obtained in a year. In other words, 23,227 lb. of agricultural produce might by improved cultural methods be obtained per acre.

The phosphate deposits of the island of Nauru in the Pacific are stated by the President of the Board of Agriculture, New Zealand, to be sufficient to meet the demands of the world for 200 years. The quality of the phosphate is said to be of the highest grade (85-86 per cent.) There are several phosphatic islands in the Pacific, but Nauru contains the largest quantities of the high-grade phosphates in the world. (*West India Committee Circular*, April 15, 1920.)

As a result of the work in Mauritius of the Station Agronomique during many years, and of the Department of Agriculture since its inception, there have been accumulated a large number of varieties of sugar-cane, most of which have been produced locally from seed, and some imported from other sugar countries. At the present time there are probably from 6,000 to 7,000 varieties at the Central Experiment Station and at Pamplemousses, and the number is being annually increased by new seedlings and importations. (The *Colonial Journal*, April 1920.)

The world is producing less sugar to-day than it did before the war, and the rate of consumption is increasing. Before the war the world had a sugar reserve, which in some years approximated to 1,000,000 tons. This reserve had been built up slowly, and represented the accumulation of years. The early years of the war wiped this reserve out completely, and it will take years to build up another reserve. There is no prospect of sugar prices going lower during the present year, and the rising price is carrying with it the prices of 'soft drinks' and candy. (*Louisiana Planter*, May 8, 1920.)

The *Agricultural Journal of Egypt*, Vol. IX, page 108 states, that, when glancing at the figures for population and for the area of cultivated habitable land, it would appear that there should be no lack of agricultural labour in Egypt. For a population of 12,500,000 there are about 6,000,000 acres of cultivated land, or about 1,300,000 people to the square mile. The country is almost exclusively agricultural, and is possessed of such a productive soil that the intensive system of cultivation practised gives employment normally to the whole of this large population, and leaves some tracts even without a sufficiency of labour.

It is stated in *Tropical Life*, April 1920, that of 2,315 rats examined last year for plague after having been caught in the London docks four were found to be infected. One wonders, therefore, what proportion of these infected vermin would be actually found at the various shipping centres, especially the ports of the East. Even in London it is stated that over 36,000 rats were destroyed at the docks or on board ships during 1919, and as during that period eight actual cases of plague, and four suspected ones among seamen were reported, it is easy to realize how an epidemic of the dreaded plague may occur from that pest of agriculture and menace to public health, the rat.

In his speech at the closing of the Session of the Legislature of the Bahamas on December 18, 1919, His Excellency the Governor stated that he had been able to arrange for the importation of a small decorticating machine for sisal, at a cost of less than £300. The portable nature of this machine, no part of which is to be heavier than 2 cwt., will permit of its being taken to pieces, and transported from district to district, and set up as required. The manufacturers, Messrs. Robey & Co., of Lincoln, are satisfied that, if properly worked, it will turn out 1 cwt. of clean sisal daily. This machine will, it is hoped, go far to solve the difficulty in the Bahamas of hand-cleaned sisal.

The Report of the Royal Commission on the Australian Sugar Industry was presented to the Commonwealth Parliament on March 19. The report states that the value of sugar land in New South Wales and Queensland was £5,541,486, and the capital invested in sugar mills and machinery £4,500,000. In Queensland the industry employs 14,500 persons apart from those working in the sugar mills. Besides these, 1,550 coloured aliens have obtained permits from the Agricultural Department to work in the sugar industry in Queensland. It appears from evidence given that Italians are making a premanent home in the sugar districts, and the opinion is expressed that they are and will be a valuable asset to the industry. (*International Sugar Journal*, May 1920.)

An information Circular of the United States Department of Agriculture states that, as a result of an investigation into substitute sugars, it has found maltose to be the most promising. National prohibition allows a considerable amount of grain, which otherwise would have been used for the brewing of beer, to be utilized for the manufacture of this sugar. Malt sugar is stated to have much resemblance to maple sugar, and to be an excellent substitute for cane sugar. For cooking and baking purposes, and for some forms of candy manufacture, it is considered in some respects to be superior. Its price at present is about 9c. per lb. It is characterized as 'an excellent, wholesome syrup, of delicious flavour.' (The *International Sugar Journal*, May 1920.)

AGRICULTURE AND FORESTRY IN SURINAM.

The Surinam Research Commission, which visited that colony on behalf of the Dutch Government in February 1919, has issued its report, a review of which appeared in *The Times* Trade Supplement, May 1, 1920. From this review the following interesting paragraphs are reproduced.

According to the report, the superficial area of Surinam is about four and a half times that of Holland. The land slopes down in roughly parallel terraces from the mountains on the Brazilian frontier to the sea. From the agricultural point of view the coastal strip with its very fertile clay soil is the most worthy of attention.

On December 31, 1918, the inhabitants of Surinam numbered 106,386, of whom rather less than 40,000 were living in Paramaribo, the chief town.

The fact that there are so many navigable rivers and creeks has naturally led to most of the traffic being carried on by water. But the lack of good roads is making itself felt more and more strongly.

The report outlines a scheme for developing the Department of Agriculture.

With regard to sugar, it is remarked in the report that the present cost price per ton is much too high for future trade, and the following measures are proposed to bring about a reduction, assuming that it proves possible to arrive at a favourable solution of the labour question: (1) extension of the surface under cultivation; (2) increase of the output by means of mechanical tillage, manuring, and irrigation, (3) modernization of factory installations and introduction of continuous running; (4) improvement of the conditions of the personnel.

With regard to cacao, the Commission is of opinion that the cultivation of this product should be maintained. In this connexion it holds the following views: (1) Surinam is an especially suitable country for the cultivation of cacao; the trees thrive well there and attain a great age; (2) the cultivation of cacao necessitates less labour than that of other products; (3) no expensive plant is required for the working up of the product; (4) if the cultivation is for export, and supported by capital, the output can easily be increased; (5) the special diseases the trees are subject to must be combated; (6) it is probable that the consumption of cocoa will increase, and the price will rise owing to prohibition in the United States; (7) with proper attention it is quite possible to cultivate coffee and simultaneously cacao on one and the same plantation, and thus the risk can be distributed; (8) as the cost of running plantations will increase, large concerns will have the best chance of working with a proper margin of profit.

The Commission is of opinion that Liberian coffee has already proved itself to be a suitable and profitable plant for cultivation in the alluvial districts of Surinam. But it must be borne in mind that the cost of exploitation will increase, although, on the other hand, it may be expected that the market will remain at a higher level than before the war.

As regards other crops the Commission strongly recommends the cultivation of oranges, bananas, coco-nut palms, sisal, and cassava; in respect of tobacco, oil palms, and cotton, the Commission is less optimistic.

In the chapter dealing with forestry, attention is drawn in the first place to the possibilities open to Dutch capital in exploitation of mora timber, which is a quality of timber as yet little known, but very suitable for shipbuilding purposes. There are at least 12,000 hectares of ground carrying mora. With regard to balata, the report states that production is restricted in Surinam, Demerara, Venezuela, and French Guiana, and that this product will continue to fetch a good price in future, but that the concerns engaged in the trade will have to spend considerable money in opening up fresh sources of supply, and that there is no profitable opening for fresh capital in it.

The labour problem can, in the opinion of the Commission, only be solved by means of immigration. Chinese, Japanese, natives of British India, and Javanese are suitable, but the report states that the two first categories must be left out of consideration as far as colonization is concerned, for the Chinese refuse to become colonists, and colonization by Japanese would probably lead to complications. The immigration of natives of British India is rendered almost impossible by the strict laws controlling such immigration, so that Surinam is compelled to fall back almost exclusively upon Javanese to increase its population. But without energetic furtherance of immigration no development is possible; it is altogether out of the question to revivify the languishing colony by means of influx of new capital alone, because every new large concern that is established there deprives already existing concerns of labour.

THE FUTURE OF BAY OIL.

An editorial in the *Perfumery and Essential Oil Record*, May 1920, points out that there are many indications of latent enterprise in the West Indian bay oil industry. The Governments of several of these islands are doing their best through the Agricultural Departments, to stimulate that enterprise. In Montserrat, for instance, good work for several years past has been done in this connexion at the experimental plot in the Botanic Station. In 1917 the average yield of oil there per 100 lb. of leaves was 17·8 oz., the actual weight of green material used having been 6,515 lb., and the actual total yield of oil having been 71 lb., thus giving a calculated return per acre, at the value of 13*s.* per lb. of oil, of £46. There has also been a considerable improvement in the quality of the oil obtained. For instance, the average phenol content of the oil in the years 1914-16 was 15·9 per cent., which rose in 1917 to 55·0 per cent.

Official encouragement to the industry is also recorded from St. Lucia, where the Agricultural Department realizes that a prosperous industry can be developed in this direction. This view seems to find recognition in several of the West Indian islands, but the growers of bay trees are reluctant to extend the area under their cultivation, or to invest capital in distillation apparatus, without some reasonable assurance of an expanding market for the product at remunerative prices.

The editorial referred to above is ignorant as to what growers and distillers of bay oil would regard as a reasonable and satisfactory price, but, it is stated, that if they can produce bay oil at a cost which would enable it to be sold at the same price as thyme, lemon grass, and other oils of a similar character, it is probable that its consumption in the perfumery trade would increase rapidly.

PLANT DISEASES

BLACK SPOT AND BARK ROT OF CACAO.

The following description of two diseases caused by the same fungus attacking cacao trees in Ecuador, and not recorded as yet from any other cacao-producing country, is freely translated from the Spanish of Mr. J. B. Rorer's handbook on the diseases of cacao in Ecuador. from which also the description of the 'watery' or Monilia disease was taken, which appeared in the *Agricultural News,* May 1, 1920.

THE BLACK SPOT DISEASE OF THE PODS.

This disease does not appear to have been previously distinguished from that to which Mr. Rorer has given the name 'watery' or Monilia disease, although it is probable that it has occurred in examples received from Tenguel and and Machala, and has been described partially under the generic name of 'spot.'

Mr. Rorer met with it on all the estates he visited, and it was practically the only disease which was found in the district of Machala, and in that which extends from estate Maria as far as the environs of Vinces. In other districts it is present occasionally on the pods attacked by the 'watery' disease, but does not cause so much damage. Black spot does not appear except on pods already full-grown, and does not completely destroy the seeds in them, especially if care is taken to reap the pods before the disease has taken full possession. Nevertheless it is true that the fungus causes great damage by its occurrence in the branches as well as in the trunk of the tree, as will be described.

Description of the disease.— The first manifestation of this disease is made in pods almost ripe. On the surface of these, one or more dark spots may be observed, and these gradually increase in size, attaining a measurement of 2 to 4 c.m. in diameter. These spots are darker than those characteristic of the 'watery' disease.

In the centre of these spots the mycelium of the fungus appears in the form of a very white, almost shining network, not so thick, however, as in the case of the Monilia. If such spots are examined with a hand lens, sooner or later the presence of a great number of minute, vertical stalks, of a black colour, and 1 mm. in length, will be noticed ; these stalks terminate in a minute, round, white head, like a tiny pearl. When a pod attacked by this disease is cut open, it will be noticed that the interior presents the aspect of having been invaded by a dry rot, such pods being always lighter than normal ones of the same size ; occasionally in such instances, the seeds germinate within the pods. The appearance of the spots in the interior of the tissues of the pods is very dark ; they do not present the striped or marbled appearance which characterizes so distinctly the 'watery' disease.

Cause of the disease.—Black spot is caused by a fungus which belongs to the genus Sphaeronema. This fungus produces two kinds of spores ; the one kind, the conidia, are produced on the surface of the pods and form the whitish mass observed on the spots; the other kind, the pycnospores, are produced in small receptacles contained within the epidermis of the pod ; these reach the exterior through the black stalks already described, which are in reality hollow, and are grouped together at the tip in the white mass which has been compared to a pearl. There can be no doubt of the parasitic character of this fungus ; more than thirty inoculations effected on healthy pods have resulted in the appearance of the characteristic rot, and have also reproduced the black spot. The fungus probably belongs to a new species.

THE BARK ROT OR 'CUTLASS' DISEASE.

This is a disease which apparently has escaped unnoticed, although it exists to a greater or less extent on almost all the cacao trees growing in Ecuador. Fortunately the trees of the variety 'Nacional' are more or less resistant to it, but the same cannot be said of the variety 'Venezuela', which is extremely susceptible, so that thousands of trees of this variety have been already destroyed by it. Mr. Rorer suggests the name of 'cutlass' disease for this affection, because practically every cut made on a cacao tree with that instrument becomes infected, and subsequently gives rise to the disease.

Description of the disease.—The fungus which produces this disease cannot attack a tree through healthy bark, except perhaps on tender twigs or shoots ; the presence of a wound or cut of some kind is necessary. When a wound which has been produced by careless pruning, or from any other cause, is examined, it may be noticed that the exterior surface of the bark around the cut has become discoloured, and if the weather is damp, a dark wine-coloured liquid may be observed dripping from the cut. If a superficial slice be taken from the bark, the interior tissues present a yellowish or reddish colour, which frequently extends for some distance above or below the wound, and also occasionally right round the branch. A dark line generally separates the healthy tissues from those attacked. All the discoloured area is found infested by the parasitic fungus, and cannot perform any function. In 'Nacional' cacao trees the disease does not spread, but the canker cicatrizes and heals, owing to the formation of new bark below the diseased portion. In 'Venezuela' cacao however, this rarely happens, so that the trees remain diseased, and at length die.

Cause of the disease. The cause of this disease appears to be the same fungus, Sphaeronema, which has been already described in connexion with the disease of the pods called 'black spot.' This fungus has been repeatedly isolated from diseased areas of the bark, and the disease reproduced by means of inoculation with pure cultures. It has further been isolated from shoots which possessed dusky areas, discoloured on the surface. It is therefore probable that these injuries also are caused by the same fungus.

A small portion of the canker which occurs on cacao trees in Ecuador may be caused by Phytophthora, because this fungus is parasitic on the bark as well as on the pod.

Preventive measures.—As the Sphaeronema fungus infects the trees wherever a wound is found, the most efficient preventive measure will be to avoid wounding them. Cuts in pruning ought to be made with care, and disinfected by covering over all the large wounds with a coating of some antiseptic substance. Unnecessary cutlass cuts ought to be avoided in every way.

The shoots ought not to be pruned away at the same time the cacao is reaped, in order to avoid infection of the ensuing wound. The spores of the fungus are so small, and are produced in such quantities, that cutlasses and pruning knives, as well as the bark of the trees themselves become covered with them.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. The Superintendent of Agriculture, Mr. R. O. Williams, writes to say that the 2 acres of Marie Galante cotton on the Government plot in the Experiment Station yielded 470 lb. of lint and 1,191 lb. of seed-cotton Plant distribution during the month of May comprised 1,510 coco-nuts imported from Dominica, 52 lb Sea Island cotton seed and 110 lb seed corn from St. Vincent, 280 lb. Marie Galante cotton seed from the Government plot, Carriacou, and 6 budded oranges, 11 ornamental plants, 1 packet onion seed, and 1,014 lb. of yams from the Botanic Gardens. In addition, the following plants and seeds were also distributed free in connexion with the Food, Crops Campaign: yams, 98 lb.; tannias, 2,107 lb; corn 400 lb. Regarding staple crops, it is stated that cacao is in bloom, and young pods, a few inches in length, are already to be seen. There is still a demand for seeds of Marie Galante cotton for planting in Grenada. All the seed from the Carriacou plot has been sold for that purpose, or distributed free to peasants entering the cotton prize competition at Carriacou 'Jolly Minstrel', a thoroughbred American racing stallion was imported recently and is stationed at St Andrews for service. A purebred Duroc-Jersey sow has also been imported Butchers meat continue to be scarce The rainfall recorded at Richmond Hil during the month was 1·25 inches.

ST. LUCIA. During the month of May the following plants were distributed: 21 grafted mango, 9 ornamental, and 48 packets of vegetable seeds. Mr. Brooks states that the manufacture of syrup continues to be general throughout the island, finding a ready sale at 3*s*. 6*d*. per gallon. The lime crop is coming in slowly. Distilled lime oil is realizing 8*s*. per lb., and cables have been received from England offering contracts at £47 per pipe for concentrated lime juice for the whole of the 1920 crop. The conditions as regards the cacao crop remain normal. The rainfall recorded at the Botanic Gardens for the month was 4·75 inches, at the Agricultural and Botanic Station 3·94 inches were registered.

NEVIS. Consequent on the prevailing dry weather operations in the Experiment and Botanic Stations have been at a standstill, Mr. Howell states. The reaping of the sugar-cane crop is still in progress, but some of the fields are almost dry. The young canes are suffering much from want of rain, and in many places have died out. All the sugar made is being sold locally at good prices. The provision crops have practically all been reaped, and there will be a great shortage of planting material, especially of potato vines, consequent on the dry weather. The rainfall for the month was 1·22 inches, and for the year to date 9·04 inches.

BRITISH VIRGIN ISLANDS. The protracted drought was broken by a downpour of 4 inches of rain on the night of May 27, according to notes forwarded by the Curator of the Botanic Station, Tortola, Mr. C. A. Gomez. The reaping of the cotton crop was brought to a close at the end of the month. There are yet fields of old cotton to be seen in the Presidency, and it would appear that special plant legislation will be necessary to enforce the destruction of old cotton plants each year. Cotton planters who had their land cleared took advantage of the heavy rains of May 27, and cotton planting may now be said to be in full swing. There is a marked increase in the area under preparation for cotton planting in Jost van Dykes. The rainfall for the month was 4·97 inches.

AGRICULTURE IN BARBADOS.

Very refreshing rain fell on Friday, May 28. It did not fall all over the island, and the several amounts registered in the different parts where it fell vary considerably. In the black soils an average of 50 parts fell. In the red soils one estate recorded as much as 1¼ inches. In St. Andrew there was an average fall of 80 parts. This rain was followedby great heat.

In St. George the average rainfall at the end of May was 1¼ inches; at one estate in Christ Church 4 inches were recorded.

The first four days of June were practically dry; only about 2 parts of rain fell in the red soil districts. This spell was broken by some very welcome showers on the 5th and 6th, and on the 7th thick clouds hung heavily in the east, accompanied by a thick mist which developed into a downpour of 1½ inches in the black soils and over half an inch in the red soils.

Every where efforts are being made to prepare fields for yams, and where, after the last rains fell, the fields were forked, gangs can be seen making yam beds, and yams being planted

There has not been sufficient rain in some parts of the island to allow a general planting of corn, only where fields were prepared and lying fallow some has been planted. It is too dry to plant potatoes, and in the old plots the vines are so dry that no cuttings can at present be obtained. Rain fairly distributed is still sadly needed.

Planters are now busily engaged in supplying chemical manure to there ratoons, which was delayed on account of the dry weather, and are making every effort to get their fields ready for potatoes as soon as their yam plots are completed.

There has been a great shortage of sugar manufactured this year; one estate in Christ Church has made olny half the crop it made last year. In St. John one estate made 140 tons less sugar than it generally makes each year; on the whole every estate in the island, except a few in St. Andrew which have not suffered from the drought, will close with results far behind last year's.

Estates in the red soils are gradually dropping off second ratoons and are sticking only to first and second crop canes. The red soils need careful treatment and tillage to make them very productive, and planters should do all they can to keep up their fertility by the application of lime, and then liberally manuring with farm yard manure.

Fodder is still very scarce, and one dollar per hundred lb. was paid in the country this week for cane tops; if frequent showers occur the situation will soon be relieved.

Potatoes are being retailed at 4c. per lb. (The Barbados *Agricultural Reporter*, June 12, 1920.)

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, May 27.

BALATA—Venezuelan Block, no quotations; West Indian Sheet spot value, 4*s.* 6½*d.* to 4*s.* 7*d.*, near positions, 4*s.* 3*d.* c.i.f.,
BEESWAX—No quotations.
CACAO—Trinidad, 140*s.* Grenada, St. Lucia, Dominica, No quotations Jamaica, 126*s.*
COPRA—£59
HONEY—.80*s* to 100*s.*
LIME JUICE—Raw, No quotaions Concentrated, no quotations.
PIMENTO—5½*d.*
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T. S. GARRAWAY & Co., June 23.

ARROWROOT—$9·00 per 100 ℔. duty paid.
CACAO—Lottings at 24c.
COCO-NUTS—$52·00 husked nuts.
HAY—Market bare.
ONIONS—Sales at $6·75.
PEAS, SPLIT—No quotations; Canada, Market bare.
POTATOES—$8·50.
SUGAR—Market bare.

London.—THE PERFUMERY AND ESSENTIAL OIL RECORD, May 17.

BAY OIL—27*s.* to 30*s.*
LIME OIL—7*s.* 9*d.* to 27*s.* 6*d.* for West Indian distilled, and for hand-pressed.
ORANGE OIL—West Indian, 35*s.*

Trinidad.—Messrs GORDON, GRANT & Co., May 5.

CACAO—Venezuelan, $25·70 to $26·00; Trinidad, $24 00. to $24·50.
COCO-NUT OIL—$2·35 per gallon.
COFFEE—Venezuelan, $5·50 per famga in bond.
COPRA—10½c. per ℔.
DHAL—No quotations
ONIONS—$15·00 per 100 ℔. Light stocks.
PEAS, SPLIT—$10·00 per bag.
POTATOES—English, $8·00 per 100 ℔.
RICE—Yellow, $13·00 to $13·50. White, $14·00 per bag.
SUGAR—No quotations.

New York.—Messrs. HUTH, GILLESPIE & Co., Inc. May 26.

CACAO—Caracas, 19c. to 19½c.; Grenada, 18c. to 18½c.; Trinidad, 18¼c. to 18½c.; Jamaica, 13½c. to 14½c.
COCO-NUTS—Jamaica selects, $57·00 per M; Trinidad $53·00 per M; culls, Jamaica, $36·00; Trinidad $35·00 per M.
COPRA—9¼c. to 9½c.
COFFEE—Jamaica, 17½c. to 24c. per ℔.
GINGER—38c. to 42c. per ℔.
GOAT SKINS—Jamaica $1·20; Antigua and Barbados, $1·15 St. Thomas and St. Kitts $1·15
GRAPE FRUIT—Jamaica, $4·00 to $4·75.
LIMES—No Market.
MACE—36c. to 38c.
NUTMEGS—26c.
ORANGES—$3·50 to $4·00.
PIMENTO—8¼c. per ℔.
SUGAR—Centrifugals, 96°, 21½c.; Muscovados, 89°, 19¾c.; c. & f., Molasses, 89°. 19¾c.

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May 15, 1920.

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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

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The Art of Gardening.

THE editorial of the previous issue of this Journal pointed out the value in certain directions of botanic gardens, and the advisability of their being maintained; the object of the presnt article is to draw attention to what may be termed private gardening, as distinct from the gardening carried on at public expense, and by government departments in botanic gardens.

It has been said that man is by nature the gardening animal. It is quite certain that all during historic times the art of gardening has been practised by every race of mankind, of whom any literary records remain. It is clear from the opening chapters of Genesis that the Hebrew tradition pointed back to a remote ancestry devoted to horticulture; and at the period of the greatest prosperity of the Jewish kingdom, under the wise King Solomom, his gardens of pleasure, and his knowledge of plants are remarked upon. The hanging gardens of ancient Babylon, which appear to have been huge terraced mounds, artificially constructed above the level of the flat Mesopotamian plain, were long considered to have been among the wonders of the world. The Persian conquerors of that ancient civilization are also stated to have constructed vast gardens and parks as pleasure grounds or 'paradises.' The Greeks seem to have been more attracted to what may be called landscape gardening than mere horticulture, and the gardens of the Roman Emperors and their wealthy subjects, surrounding their villas in the genial clime of Italy, are frequently referred to in classical literature.

Turning to ancient civilization in the far East, the palm for scientific practice of the art of horticulture from very early times must probably be awarded to the Chinese and the Japanese, the gardens of the latter race being even now models of beauty and taste.

European civilization, after the break up of the Roman Empire, seems to have inherited and maintained, in all the countries upon which the influence of Roman culture continued to be felt, a taste for horticulture. After the renaissance in the fifteenth century horticulture was developed into a fine art. Sovereigns and nobles vied with each other in laying out stately pleasure grounds and gardens after elaborate plans, which they stocked with the rarest and most beautiful trees and flowers obtainable. The exploitation of the sea route to the East Indies, and the discovery of the New Western World, with their tropical treasures of gorgeous flowers, assisted in the advancement of the art of gardening, and the interest taken in gardens.

This pleasure in stately and expensive gardens has continued to be evinced among the members of the wealthier classes in Europe and America up to the present time. Scientific planning of a considerable area, so as to afford varied prospects of beauty derived from plants in groups, or lines, or masses, has reached in those countries a pitch of great perfection. No one who has ever seen a garden of several acres in extent surrounding one of the 'stately homes of England' can ever forget its ordered beauty, which is due to a combination of science and art fostered by a liberal use of pecuniary resources.

In the colonies, however, especially in the smaller ones like these of the West Indies, there has been, up to the present, practically little or no scientific private gardening on a large scale. The fact is that trained, skilled gardeners do not exist among us. Men who are capable of planning pleasure grounds on a large scale, or of laying out extensive gardens in accordance with the canons of the best taste, command higher salaries than have hitherto been within the reach of the owners of West Indian properties. On many of these properties there exist fine houses—in almost every case with some sort of a garden attached—but one often wonders whether a planned and ordered garden of several acres in extent surrounding such residences would not be an investment worth while from the points of view of social and æsthetic values, although it might not be a paying one pecuniarily.

In the early days of the settlement of the West Indian colonies the colonists had to maintain too hard a struggle economically to be able to devote either attention or time to much beautifying of their surroundings. Later on, when a West Indian property was better than a gold mine, most of the larger proprietors retired to a life of ease in Europe, leaving the administration of their properties to factors, whose instructions were to make as much money for the owners as possible. Consequently such æsthetic matters as gardens did not receive much attention. Still later, there came the collapse, to a large extent, in the value of those properties. The owners had no money then to be able, even if they wished, to indulge in such expensive tastes as scientific horticulture.

Now, however, brighter days seem to be in store for these colonies. Owners of West Indian estates on which there still exist fine houses, can allow themselves considerable indulgence in matters of personal taste. It is true that the setting apart, say, of many acres of an estate, as pleasure grounds and gardens around the mansion, would involve the loss of a certain amount of sugar-cane and its products. Still, however, it would seem that men—and there are many—to whom plants and trees are objects of great interest, might devote some portion of their income which they can set aside for pleasure to making their grounds and gardens things of beauty and delight, not only to themselves, but to others. Many men nowadays in the West Indies can afford, and do afford to spend for pleasure considerable sums of money, as for instance in acquiring pictures or other objects of art. It may be that there are others who may be tempted to spend freely on their gardens. The success of this, however, can only be ensured by employing trained men to supervise the work.

The foregoing remarks have dealt only with gardening on a large scale. Small gardens, however—and by gardens in this connexion are only meant pieces of ground, however small, cultivated not for economic product, but merely for the production of ornamental plants—are well worthy of consideration. Here again in these smaller colonies we need trained instruction. There is hardly a house, from the labourer's cottage up to the villas of the middle class, where some attempt is not made to grow a few plants for ornament. In many such small gardens, however, there is an effort to do too much: they suffer from an excess of zeal and a lack of knowledge. Consequently such gardens for the most part, although they afford, it is true, much pleasure to their owners, scarcely convey the idea of ordered beauty which is such a marked feature of even small gardens in larger countries. If it were possible for the owners of gardens in any one locality to co-operate, and by a combination of resources to employ a skilled gardener trained, say, in England or the United States, who would superintend their gardens, and give instruction in the art of gardening, it might well be that the small gardens in such a locality would become things of permanent beauty, and that, benefiting by such skilled superintendence and instruction, a race of gardeners would arise who would hand down their science and art for generations to come.

THE ROTHAMSTED EXPERIMENT STATION.

The following résumé of the history, aims, and work of the famous Rothamsted Experiment Station—probably the most famous of such stations in the world—is reproduced from a leaflet issued to the members of the Imperial Entomological Congress on their visit to Rothamsted during their recent meeting in London.

The Rothamsted Experiment Station has grown up in typically British fashion. It began in 1843 with chemical experiments in a barn, and manurial trials in two fields; important results were obtained, the fame of which gradually spread till in 1854 the farmers of England subscribed to build a proper laboratory in which more detailed chemical work might be carried out. For fifty-eight years Lawes and Gilbert worked together, Lawes bearing the whole expense of the experiments; in 1889 he founded the Lawes Agricultural Trust, and endowed it with £100,000 so that the work could continue after his death. The results of the older Rothamsted experiments revolutionized agricultural science and practice in all parts of the world. The best known achievement was the introduction of artificial fertilizers, but

equally valuable work was done in connexion with the feeding of animals, the study of soil fertility, and the interrelationships of animals and crop husbandry. From the outset, however, Lawes and Gilbert confined themselves to the discovery of the scientific principles underlying the operations of agriculture. 'The object of these investigations,' said Sir John to the farmers assembled at the opening of the old laboratory in 1855, 'is not to put money into my pocket, but to give you the knowledge by which you will be able to put money into yours.

'Science will impart to the landlord a good knowledge of the qualities of his own land, and it will enable the tenant to turn to the best account the floating capital which he has embarked in the soil.' This acquisition of knowledge of the soil and the growing crop has remained the leading purpose of the Station throughout all the years of its existence.

Lawes died in 1900, and Gilbert in 1901. They were succeeded by A. D. Hall who reorganiezd the work and brought it into line with the current needs of agriculture. The problems had changed and new methods were required: Mr. Hall saw that nothing less than a great national organization would suffice for the task. A scheme was subsequently developed which provided advice for farmers to be given by competent local advisers, and instruction for those about to farm. It was an essential part of the scheme, however, that there should be Research Stations to furnish definite information and precisely ascertained facts which teachers and advisory experts could use, otherwise their work would lose much of its value, and might even be dangerous. The scheme is now in operation, and two of the Research Institutes are located at Rothamsted, one for the study of soil and plant problems; the other, more recently established, for the study of plant pests and diseases.

In 1912 Mr. Hall (now Sir Daniel Hall) resigned the Directorship and became, at first, Development Commissioner, and then Permanent Secretary to the Ministry of Agriculture. He was succeeded by the present Director, Dr. E. J. Russell.

Considerable developments were necessary, in order that Rothamsted might fit into the new national scheme of Agricultural Education and Advisory Work. Science has made great strides since 1843, and much careful searching is needed to discover what out of all its wealth of facts and principles can aid in the development of British agriculture. This search requires a number of workers, each with a knowledge of some branch of science, and each seeking to extract something from science that will throw light on the problems of soils and of crop production. The old laboratories proved insufficient for modern requirements; during the last seven years they have therefore been replaced by the present buildings, and, the permanent scientific staff has been increased from nine to twenty-six, in addition to the post-graduate research workers. In the same period the farm has been increased from 60 acres to 279 acres; it has been completely equipped and provided with adequate buildings.

The new laboratories, like the old, were erected by public subscription, but with the important and significant difference that the Ministry of Agriculture, through the Development Fund, provided a substantial portion of the money. The buildings, fittings, and farm equipment and buildings have cost approximately £26,000, of which £10,000 was raised by public subscription, £10,000 was given from the Development Fund, and the remainder by private donors and in other ways. In addition, munificent gifts of rare books and of furniture for the library and the Director's room have been received.

The cost of carrying out modern research work is considerable; many of the easily ascertained facts and principles are already known; further progress is achieved only after systematic work, and much rejection of unsuitable or uncertain material. Every possible precaution has to be taken against error. All this is very costly. The expenditure on both institutes in 1918-19 was approximately £13,430, of which the Board of Agriculture provided £8,500, the Trust income was £2,731, and the remainder came from private donors and subscribers. The expenditure, however, is likely to be considerably greater in the near future, cost of salaries, wages, and materials having much increased.

The future work of Rothamsted is projected on broad lines. First and foremost is the search for new knowledge about soils, fertilizers, the growing plant, and its fungus and insect friends and foes. There is also the re-examining and re-arranging of existing knowledge, putting it into a form suitable for modern farmers, farm workers, and farm students. Further there is the study of technical problems, such, for instance, as the possibilities of reducing the present wastage of farmyard manure, the utilization of sewage as manure, the improvement of basic slag, the best possible means of utilizing the new power which the tractor has placed in the hands of the farmer, and the control of harmful organisms. And, as hurried work is never good work, the problems are as far as possible attacked before they have become really urgent, so that they may be well on the way to solution when the information is needed.

A NEW SOURCE OF MEAT SUPPLY.

People are so accustomed to think of meat as the flesh of the common domesticated animal, that perhaps it will seem strange if the flesh of wilder beasts such as the reindeer, the caribou, and the musk ox, were found largely supplying the meat markets of the world. Yet from an article in *United Empire*, May 1920, it appears that such an event is not only possible but probable in the near future.

A new industry has been inaugurated in Canada, with the widest possibilities. In the vast regions of Northern Canada, stretching to the Artic Circle, enormous heards of reindeer and caribou range unmolested. Contrary to popular conception, this area experiences a beautiful though short summer, and grows a thick, heavy vegetation, which provides an adequate supply of nutritive food to those animals through summer and winter.

Recently there was laid before the Premier of Manitoba a scheme to turn the uncultivated portions of northern Manitoba, Ontario, and Quebec into one vast reindeer farm. This plan is also before the Ontario and Quebec Governments and the co operation of the Federal Government is practically assured. It is proposed to stock this enormous area with reindeer imported from Norway. Thus, it is believed, an enormous source of meat supply would be created, which would be a source of profit to the Provincial Governments.

There is no fodder question to cause trouble and worry, as in the case of cattle, and it is stated to be possible for one man to take charge of a herd of a thousand of these animals. The milk, flesh, and hides are all valuable, reindeer meat, in fact, commanding a higher price than beef, and it is asserted that the Canadian barrens could support 50,000,000 reindeer, worth a huge sum of money.

THE IMPERIAL ENTOMOLOGICAL CONFERENCE.

It will doubtless be remembered by readers of this Journal, that Mr. H. A. Ballou, M.Sc., the Entomologist on the Staff of the Imperial Department of Agriculture for the West Indies, recently went to England to attend, as an official delegate on behalf of the Department, the Entomological Conference to be held in London.

A brief interesting account of the proceedings of the Conference appeared in *Nature*, June 17, 1920, from which the following is chiefly taken.

The Committee of the Imperial Bureau of Entomology may be congratulated on the success of the Entomological Conference which met on June 1-11 in the Linnean Society's rooms, Burlington House, London. The conference was attended by twenty official delegates representing most of the British Dominions, Colonies, and Protectorates, as well as by members of the Committee of the Bureau, while a number of entomologists were invited to the meetings and discussions which occupied most of the appointed days. At the opening of the conference the delegates were received by Viscount Harcourt, chairman of the committee, and business meetings were held on the first and final days On Friday, June 4, the conference visited the Rothamsted Agricultural Experiment Station in conjunction with a meeting of the Association of Economic Biologists

On Tuesday, June 8, the members journeyed to Oxford, and on Thursday, June 10, to Cambridge. While the entomological collections in the University museums were the chief objects of interest, time was found for brief inspection of some features of the historic cities.

Of the meetings held on the other five days of the conference, it may be said that several subjects of much importance and of general interest were well and earnestly discussed. On the morning of June 2, under the presidency of Dr. R. Stewart MacDougall (Edinburgh), Mr. C. P. Lounsbury (Entomologist to the Union of South Africa) spoke on 'Legislation in Regard to Plant Pests in the British Empire,' insisting that the official entomologist should have authority to draft and enforce regulations against the introduction of plants which might harbour harmful insects; he advocated the drastic exclusion of such plants except in certain special cases, and expressed the opinion that little or no reliance can be placed on certificates of freedom from pests—a view afterwards supported by several others who took part in the discussion. Mr. H. J. Elwes, however, remarked that a long experience in cultivation had convinced him that needless interference with freedom of import had sometimes been exercised by the authorities. On the chairman's suggestion, a sub-committee was appointed to consider the establishment of an Empire Convention on the subject.

'The Education of Entomologists,' the subject for discussion at the next morning meeting presided over by Professor Poulton, was introduced by Prof. H. Maxwell-Lefroy (Imperial College of Science). Professor Lefroy advocated the establishment of entomology as a subject independent of general zoology, and, describing the courses in his own college, emphasized the necessity of a broad scientific training in physics, chemistry, and biology before the specialised entomological work could be profitably taken up; men with exceptional aptitude, however, might be admitted direct to advanced entomological study.

While some doubt was expressed as to the advisability of divorcing entomology from general zoological study, there was general agreement as to the need of a sound and comprehensive scientific training, and several of the speakers insisted further, that all entomologists in direct contact with cultivators, ought to have practical knowledge of farm or garden work.

On Monday morning, June 7, Sir Daniel Morris in the Chair, Mr. H. A Ballou (Entomologist to the Department of Agriculture for the West Indies) opened a discussion on 'The Resistance of Plants to Insect Attacks.' He believed that in many cases perfectly healthy plants do not afford the best possible conditions for the life of sucking insects, while the food-supply derived from weak or diseased plants may stimulate insects to abnormally quick growth and prolific reproduction. This view was supported by the infestation of thrips on cacao trees in the West Indies. Prof. D. R. Watt emphasized the possibility of finding strains of cultivated plants immune from insect attack, analogous to those now well known in certain cases as immune from fungus pests Mr C. C. Gowdey (Uganda) considered good cultural methods as of great importance in maintaining the resistant conditions.

A cognate subject, 'Artificial *versus* Natural Methods of Control of Insect Pests,' occupied the conference on Wednesday morning, June 9, when Prof. R. Newstead presided. Mr. F. W. Urich (Trinidad) opened the discussion with an account of various measures adopted in the West Indies, of which the distribution by means of spraying machines of fungus spores for the destruction of cercopids on sugar-cane was the most remarkable. Dr. Tillyard regarded spraying with insecticides as an imperfect palliative, and looked hopefully for results in poisoning aphids and scale insects from the inoculation of trees with such substances as copper sulphate. Mr. F. Balfour Browne uttered a warning against the possible danger of introducing parasitic insects into new countries in order that they may prey upon previously introduced plant-feeding insects, but Prof. H. Maxwell-Lefroy and Dr. A. D. Imms regarded any danger from this now-established practice as remote.

Several interesting papers on more special subjects were read. On the afternoon of Monday, June 7, Mr. G. E. Bodkin gave his experience of the insect pests of British Guiana, and dwelt on the difficulty of controlling sugar-cane insects because of their habits of migration. On the same occasion Mr F. W. Urich described the insect pests of Trinidad, and Mr. H. A. Ballou contributed a general review of conditions in the West Indies. On the afternoon of June 9, Dr. MacDougall lectured on 'Insects in Relation to Afforestation,' with lantern illustrations, pointing out the bearing of the feeding habits of common British timber and bark beetles upon practical questions of forest management. A discussion involving the uniformity of habit among insects of the same species in all parts of its range was carried on by Mr. C. F. C. Beeson (India) and Dr. Munro (Board of Forestry). Mr. F. A. Stockdale (Ceylon) followed with an account of the insect pests of tea in that island. On the afternoon of Wednesday, June 2, when Sir David Prain took the Chair, Mr. H. A. Ballou read a paper on Cotton Pests, dwelling particularly on the boll weevil and the pink bollworm, the latter of which caused a loss of £10,000,000 in Egypt in the year 1917. Cotton insects are controlled by destroying at

the end of the season all material in the field on which the species might survive until the next season. Mr. H. H. King described the organization of entomological work in the Anglo-Egyptain Sudan, and stated that nine field laboratories, under the charge of trained entomologists, would be necessary for the proper working of the area.

Of the special questions discussed, the most noteworthy was the tse-tse fly problem, considered at the meeting on Saturday morning, June 5, appropriately presided over by Sir David Bruce. Several entomologists from Africa spoke, including Messrs. R. W. Jack (South Rhodesia), Dr. A. May (North Rhodesia), and Mr. L. Lloyd and Dr. G. D. H. Carpenter (Uganda). An experiment as to the effect on the fly of the clearance of the big game from a district in Rhodesia is now being tried. The opinion was expressed that the result of this will be disappointing, as mammalian blood forms, as a rule, only a small proportion of the food-supply of Glossina. Dr. Carpenter informed the meeting of the success which had followed the erection of inclined screens, under which hundreds of puparia are found; this means of control was suggested by an observation of the large number of puparia present in the shelter of a blown-down tree.

The conference concluded on Friday, June 11, with a business meeting at which several resolutions were passed; these may be briefly summarized. (1) A Conference should be held in London every five years. (2) The Imperial Bureau of Entomology should be established permanently; the cessation or curtailment of its work would be deplorable. (3) The Governments contributing to the expenses of the Bureau should be urged to guarantee their contributions. (4) The funds at present contributed for the upkeep of the Bureau are inadequate; they should be increased so as to provide an income of at least £13,000 a year. (5) The Colonial Secretary should be requested to establish a provident fund for the Bureau staff. (6) The director and committee of the Bureau should have full power to exercise their discretion as to the scope and contents of the publications, and the expenditure involved. (7) The director should encourge members of the staff to pay attention to particular groups of insects, especially those for the identification of which no specialist is available. (8) The provision of an adequate number of trained men to carry into effect existing plant-import legislation is of more immediate importance than the revision or extension of such legislation.

On the evening of the closing day the members of the conference were entertained to dinner at Lancaster House by H. M. Government, Viscount Harcourt presiding. Thus was pleasantly and fittingly demonstrated the increasing recognition of the importance of the study and practice of science in relation to the interests and industries of the Empire.

INDUSTRIAL ALCOHOL IN HAWAII.

In previous issues of this Journal attention has been drawn to the successful manufacture in Natal of alcohol from molasses, which, under the name of 'natalite' has largely replaced the use of gasolene for motor engines in South Africa.

From the following paragraphs, reproduced largely from an article in the *Louisiana Planter*, May 22, 1920, it is evident that a similar result is likely to be attained in Hawaii.

During the last few years in Hawaii there has been a good deal of talk concerning the need for finding some more profitable way of utilizing waste molasses of the sugar factories than shipping it to the mainland for stock feed, or burning it for potash.

There has also been a great deal of discussion of the practicability of the Foster method of making commercial alcohol from this material.

Now that gasolene is getting scarcer and dearer, and the oil producers are threatening that it will become still more scarce and more dear, the possibility of turning the cheap molasses into motor fuel is attracting some very real and serious attention.

Not only is the Maui Agricultural Company, which developed the process of its superintendent, J. P. Foster, and which has been using the new product most successfully for the past two years, enlarging its plant to a capacity of about 800 gallons per day, but the Hawaii mill, Kohala, is at present installing a plant, while the California Fruit Packer's Corporation is preparing to make 1,200 gallons of the motor fuel daily from the refuse of its Honolulu pineapple cannery. Experiments have demonstrated the practicability of this last-named source of alcohol, and the converting it into the new fuel will be made by the Foster process.

Although the Maui Agricultural Company could probably sell the motor fuel at some profit at the present prices of gasolene, Mr. Foster states that the increased output from the enlarged plant will probably not be so used, for the time being at least. He has developed a process for solidifying the product, or rather of combining it with an absorbent permitting it to be marketed in bricks and used for purposes of domestic heating. A similar product is already on the market, but its base is gun-cotton, which makes it very expensive. Mr. Foster has devised a very much cheaper means of accomplishing the same thing.

The Collector of Internal Revenue, Hawaii, has recently given assurance of his department's earnest desire to encourage the extension of the commercial alcohol manufacture in the territory in every way possible, and that every effort will be made to prevent the government's regulations from being burdensome or annoying to bona fide manufacturers.

The secret of the Foster process is in the proper combination of ether with the ordinary denatured alchohol, two-fifths of the volume of the fuel being ether for best results.

Furthermore, by the proper percentage of pyridine, one of the substancees required by the government in the denaturing process, the acid reaction of the combustion is completely neutralized, so that there is absolutely no injury to engine cylinders from its use. Mr. Foster states that engines which have been using the motor alcohol for more than a year show absolutely no ill effects from it, while, on the other hand, the trouble from carbon deposits is virtually eliminated.

Engines using alcohol for fuel develop from 10 to 20 per cent. more power than from gasolene, and consequently in motor vehicles give a greater mileage per gallon.

It is stated that the waste molasses produced in Hawaii amounts to about 135,000 tons per annum, sufficient to produce about 9,000,000 gallons of alcohol.

THE MANURIAL VALUE OF COTTON BUSH.

The following notes by the Acting Assistant Chemist of the Agricultural Department, St. Kitts-Nevis, are reproduced from the report on the Agrieultural Department of that Presidency for the year 1918-19. The results of the experiments undertaken by Mr. Kelsick seem to justify his conclusion that the practice of burning cotton plants left on the land after picking the cotton is unadvisable. except for special reasons relating to the control of insect or fungus pests.

The practice of burning the remains of cotton plants left on the land after reaping has been, and still is a general one in the cotton-growing islands in the West Indies, with the exception of St. Kitts, where the bushes have always been buired under the banks.

The reason for burning, which is enforced by law in all West Indian cotton-growing islands, except St. Kitts and Nevis, was the eradication of insect and fungus pests, but in a paper by the Agricultural Superintendent, St. Kitts-Nevis, 'Notes on the destruction of cotton bushes by burning' (*West Indian Bulletin*, Vol. XV, p. 319), it was pointed out that at La Guérite Experiment Station, where cotton was grown continuously, burying the bushes had been done instead of burning for some years with no increase of disease, and a change from burning to burying was strongly advocated.

The following notes have been written to show to what extent the fertility of the soil is being depleted in those islands where cotton bush is destroyed by burning.

In 1918 the bush remaining on the no-manure and pen-manure plots of the cotton manurial experiments was weighed after the crop had been reaped, with the following results:—

	No manure.	Pen manure.
	lb.	lb.
Series 1	159½	234½
2	148	254
Mean	153½	244½
per acre	6,140	9,780

This amount of organic material might be considered small, but in tropical countries where the decay of organic matter is very rapid, and the supply of organic manures usually inadequate, any material which will help to maintain the humus content of the soil is valuable It will therefore be seen that by burning the bushes there is an appreciable loss of useful material every year.

The amounts of nitrogen, phosphoric acid, and potash present in an average sample of this material was determined, and the following figures obtained:—

Nitrogen	2·16 per cent.	
Phosphoric acid ...	1·40 „ „	(on air-dry material.)
Potash	2·35 „ „	

These figures show that the bush has a high manurial value, and although some consideration must be given to the fact that it is returned to the land in a very undecomposed state, yet its value as a supply of potential plant food cannot be questioned.

The amouut of manurial constituents removed annually from land yielding at the rate of 1,000 lb. of seed-cotton per acre would be about as follows:—

Nitrogen	26·32	lb. per acre
Phosphoric acid ...	12·67	„ „ „
Potash	11·96	„ „ „

In computing these figures, use has been made of the figures given in the *West Indian Bulletin*, Vol. V, for the composition of Sea Island cotton seed.

The amount of mauurial constituents returned to the soil by burying the remains of the plants would be about as follows:—

Nitrogen	171·9	lb. per acre
Phosphoric acid ...	111·44	„ „ „
Potash	187·1	„ „ „

It will therefore be seen that the amounts of nitrogen, phosphoric acid, and potash returned to the soil by burying the old plants are greatly in excess of those removed in the seed and lint.

Consideration of the foregoing facts makes it evident that the practice of burning the remains of cotton plants is detrimental to the fertility of the land. In the first place, there is the loss of an appreciable amount of organic material, so essential for maintaining the fertility of tropical soils; and secondly, the land is deprived of a valuable supply of nitrogen.

The continuation of the practice must eventually lead to a state of unproductiveness, especially in the case of light soils, unless ample supplies of organic manures are available.

MANURIAL EXPERIMENTS WITH COTTON IN ST. VINCENT.

The following is a summary of the conclusions reached by Dr. S.C. Harland as the result of his manurial experiments in the cultivation of Sea Island cotton in St. Vincent. His detailed papers on the subject will be found in the *West Indian Bulletin*, Vol. XVI, p. 169; Vol. XVII, p. 20; Vol. XVIII, p. 20.

The significance of the manurial experiments with Sea Island cotton which have now been carried on for seven years, is discussed in detail in the articles referred to above. The main features of the experiments are summarized below, and those points which may be made use of in agricultural practice are here set out.

After being grown on the same land for a number of years, a practice which is general in St. Vincent, the cotton crop responds markedly to applications of both artifical and organic manures.

The size of the crop, leaving insect pests and fungoid diseases out of account, is limited by the supply of potash in the soil, although signs are not wanting that lack of nitrogen is already becoming seriously felt.

The characteristic sign of potash exhaustion, the 'rust' disease, now appears on most of the cultivated lands of the colony. It is attracting much attention, and is known locally as the 'red leaf' disease, a term which well describes its chief symptom. The warning given by Dr. Harland in the second report of this series has apparently not been given serious consideration by growers, but it may now be restated. Most of the cotton lands of St. Vincent are depleted of potash and organic matter to an alarming degree, and will soon cease to give remunerative crops. The cotton crop of St. Vincent is not now limited by the incidence of insect pests or fungoid disease, but by the supply of available plant food in the soil. It is plainly necessary to import artificial potash fertilizers.

The use of phosphate as a manure is not to be recommended, since the combination of potash and phosphate is inferior to potash alone.

Cotton-seed meal alone cannot be used in an economical manner as a manure for cotton. It should be supplemented by applications of potash and pen manure. If cotton is grown as a rotation crop with cane—a sound agricultural practice—it would be better to utilize the cotton-seed meal

and pen manure for the cane crop, and apply an artificial fertilizer containing potash to the succeeding cotton crop.

The time of maturing of the cotton crop is not affected by manurial treatment.

Differences in manurial treatment cause no notable differences in the percentage of bolls to flowers.

Under the tropical conditions of St. Vincent, there is great uniformity in the time at which flowering and bolling begin, reach their maximum, and finish. The bulk of the first crop is picked from twenty-one to twenty-four weeks from sowing.

With the increasing amount of control which has been obtained over the cotton stainer, the chief sources of loss of crop are now (a) shedding of buds and bolls, (b) external boll disease, and soft rot disease. External boll disease greatly increases the loss from shedding. The experiments concerning shedding are not yet concluded, but in regard to the control of the two above-mentioned diseases, it may be said that, while spraying is useless for the control of external boll disease, further experiments are needed to determine its effects on the soft rot disease

SOME NEW ASPECTS OF CACAO GROWING.

Under the above title, Prof. P Carmody, late Director of Agriculture, Trinidad, contributed an article to *The Times*, May 22, 1920, which is reproduced below as of general interest to cacao planters.

About ten years ago the Department of Agriculture in Trinidad, while carrying out some manurial experiments in cacao cultivation, decided to ascertain the yield of marketable cacao from individual trees. A beginning was made with about 1,000 trees, and a yearly record of yields from these has since been kept. The results were so unexpected, and so important, that the records were extended to over 10,000 trees.

The yearly records showed that the yield of individual trees was the predominant factor in the total yield per acre, or any other area, and that the trees could be broadly classified into heavy-bearing and light-bearing. The variation in the yield is very great. Some trees give a yield of less than 2lb. of dry cacao a year, some give as high as 20lb. or 25lb. The percentage of trees of the latter character was much below that of the light-bearing trees.

It was also found that a heavy-bearing tree in one year could be classed as a heavy bearer every year, and a light-bearing tree as a constant light bearer. The yield varies to some extent from year to year according to seasonal variations, but the general character remains the same.

RESULTS OF TESTS.

The value of these records will be seen from the following results. In a field giving a fairly satisfactory yield of cacao, the percentage of trees of different bearing capacity is shown for two consecutive years.

Weight of dry cacao per tree per annum.	Percentage of trees.	
	1st year.	2nd year.
Over 8lb.	17	21
Between 4lb. and 8lb. ...	32	39
,, 2lb. and 4lb. ...	26	25
Under 2lb.	25	15

The trees in the above field were between twenty-five and thirty years of age. In another field, with trees over fifty years old, the record for one year shows:—

Weight of dry cacao per tree per annum.	Percentage of trees.
Over 8lb.	1·87
Between 4lb. and 8lb. ...	13·37
,, 2lb. and 4lb. ...	26·07
Under 2lb.	58·69

In both cases the records are of natural yields under ordinary estate cultivation, and without the use of manures, and it will be seen that the natural yield from old trees is less satisfactory than that from mature trees.

Over a long series of years the average price for good marketable cacao received by estate owners in Trinidad may be taken at 6*d.* per lb., and the current expenses for ordinary estate cultivation may be taken at 3*d.* per lb. This leaves a surplus of only 3*d.*, which is barely sufficient to meet charges on capital. It will be seen from this that a yield of 1lb. per tree approximately meets the annual charges only. A yield of 2lb. per tree gives a net profit of about £3 per acre (at 250 trees to the acre), which is not sufficient in any agricultural undertaking in the tropics.

UNPROFITABLE TREES.

It follows from this that mature trees yielding less than 2lb. per annum are undesirable encumbrances on an estate, and the best course is to remove them, or to utilize the trunks for grafting or budding. Experiments are being carried out in Trinidad for the purpose of ascertaining whether buds or grafts, taken from heavy-bearing trees grown on these trunks, will give an increased yield, and so avoid the more drastic course of complete removal. The results of these experiments will not be known for a few years.

Other experiments are being tried in order to ascertain whether seeds from selected heavy-bearing trees can be relied on to produce heavy-bearing trees. The results of these experiments will decide one very important point in cacao cultivation.

To the ordinary planter it may seem quite impracticable for him to ascertain the weight of dry cacao yielded by individual trees, but a very simple way of doing this has been worked out in Trinidad. From many experiments on different estates in Trinidad it has been found that, by fermenting and curing in the ordinary way a fairly large number of pods. 1lb. of marketable cacao is obtained from twelve pods This can be relied on for ordinary seasons and for the Forastero type of cacao. It is only necessary then, to count the number of pods picked during the year from any individual tree, to ascertain with considerable, and for estate purposes, quite sufficient accuracy, the weight of dry cacao that tree will yield. With other types of cacao, and in abnormal seasons, the number of pods equivalent to 1lb. of dry cacao may vary from ten to more than fifteen; but the correct number for any estate under any conditions may be ascertained by direct experiment as indicated above.

In most of the cacao-producing colonies within the Empire this method of ascertaining the weight of dry cacao by counting the pods is now adopted in carrying out experiments, and some very interesting results have been obtained in the Gold Coast. Many small planters in Trinidad, whose operations would not justify the cost of weights and scales, have found it convenient and useful. In all countries with a large production of cacao, variations in yield in different fields, or in different parts of the same field, are of common occurrence; this method will show, with but little extra trouble or expense, the actual value of any selected number of trees in a field, or on an estate.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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†Provided by the Imperial Department of Scientific and Industrial Research.

Agricultural News

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NOTES AND COMMENTS.

Contents of present issue.

The art of gardening is the subject of the editorial.

Some habits of the corn ear worm as regards its egg-laying are described under Insect Notes, on page 218.

Under Plant Diseases on page 222 will be found two short articles, the first on the red ring disease of coco-nuts, and the second referring to the mosaic disease of sugar-cane.

A summary of the proceedings of the recent Imperial Conference of Entomologists appears on page 212.

An article descriptive of the work of the famous Rothamsted Experiment Station is reprinted on page 210.

The 'West Indian Bulletin' Vol. XVIII, Nos. 1 and 2.

Difficulties connected with printing and publishing have caused these two numbers to be issued together.

The first paper in the combined issue is a reprint of the Report presented by the Secretary of State for the Colonies by the Committee appointed to consider the question of establishing a Tropical Agricultural College in the West Indies. The question has been dealt with in previous issues of this Journal.

The second and third papers are contributed by Dr. S. C. Harland, and deal with questions relating to cotton. The first is a study on the inheritance of corolla colour in various varieties of the cotton plant. Dr. Harland's second paper continues a record of his manurial experiments with Sea Island cotton in St. Vincent. The present article deals with experiments carried on in 1918-19. The summary of the results obtained, and the conclusions arrived at by the writer are reproduced on another page of this number of the *Agricultural News*.

The fourth paper is the annual report on the prevalence of some pests and diseases of plants in the West Indies during 1918. This is compiled, by the Entomologist and Mycologist on the Staff of this Department, from imformation supplied by the agricultural officers in the several islands.

The fifth paper, by Mr. S. F. Ashby, B.Sc., Microbiologist, Department of Agriculture, Jamaica, deals with two diseases of the coco-nut palm in Jamaica caused by fungi of the genus Phytophthora.

The last paper is a short note by Mr. W. Nowell, D.I.C., Mycologist of the Imperial Department of Agriculture for the West Indies, describing infection experiments made in Grenada with regard to the red ring disease of coco-nut palms.

These numbers, although delayed as to date of issue, will be found to contain matter of distinct general and scientific interest.

Mr. J. R. Jackson, A.L.S.

We regret to announce that the Imperial Commissioner of Agriculture for the West Indies, has received a letter from Mr. J. R. Jackson, dated June 11, 1920, stating that with much regret, owing to increasing age and ill health, he is obliged to give up his monthly contribution to the *Agricultural News* which has been printed under the head 'Drugs and Spices in the London Market' from the first year (1902) of the publication of the Journal.

For many years Mr. Jackson was Keeper of Museums at the Royal Botanic Gardens at Kew. This position he resigned in 1901, but he has always maintained a keen interest in the progress of tropical agriculture, especially in the West Indies.

We sincerely hope that, although Mr. Jackson's health may not admit of his taking so active a part in life as hitherto, he may be spared to enjoy many years of well-earned rest.

Boll-weevil Danger in Porto Rico.

By courtesy of the Commissioner of Agriculture and Labour, Porto Rico, information has been received at this Office concerning the introduction of Sea Island cotton seed infested with boll-weevil into that island in January of the present year.

It appears that a shipment of 4,000 lb. of seed from the Sea Islands, viâ New York, was introduced through the Port of San Juan without notice given to the Departments of Agriculture, and in violation therefore of the law regulating plant importations. When information reached the Department in March, the seed had already been distributed and, for the most part, planted. A total quantity of 1,278 lb. was recovered, and examination of this revealed three living and 365 dead boll-weevils.

No actual occurrence of the weevil in the field had been reported at the time of writing (May). Information and warnings have been circulated among all persons concerned, constant observation is being maintained, and steps have been taken to enable any appearance of infestation to be dealt with promptly and radically.

Utilization of Lower Grade Sugars.

One result of the prevailing shortage of sugar, according to *Facts About Sugar*, May 22, 1920, is that many manufacturers using sugar in the production of various commodities are discovering that they can utilize lower standard grades without appreciably affecting the quality of the goods they put out. Candy manufacturers are reported to be using practically all grades of sugar, with the exception of raw centrifugals. Biscuit makers have discovered that washed sugars are suitable to their purposes. The tobacco trade, which is a larger user of sugar than is generally supposed, is able to absorb practically any grade. Several 'soft drink' manufacturers have been experimenting, and have succeeded in producing clear syrups from low-grade sugars. It appears that the sugars are melted and put through a simple clarification process before being used for syrup making, and that excellent results have been obtained.

Cotton Cultivation in Porto Rico.

In the editorial of *Revista de Agricultura de Puerto Rico*, April 1920, the Sub-Commissioner of Agriculture and Industry for that island, Señor Ramon Gandia Cordova, strongly advocates the extension of cotton growing in Porto Rico. He draws attention to the fact that the cultivation of Sea Island cotton seems almost to be on the point of extinction in the South-eastern States of America, but that this type of cotton is becoming more and more in demand for special industrial uses, and that consequently its production will probably be remunerative for many years to come.

He goes on to state that the soil and climate of a large part of Porto Rico are well suited to the production of this superior type of cotton, and he considers that the planters of Porto Rico would be well advised to extend the cultivation of this crop. He even looks forward to the possibility of Porto Rico being enabled to possess its own cotton mills, where the cotton locally grown could be manufactured in sufficient quantities to supply most of the requirements of the population.

The cotton growers in the smaller British West Indian islands should take notice of this possible development in Porto Rico, and should remember that the position they have attained in this line cannot reasonably be expected to persist, except by continued effort in all directions affecting the industry.

The Sugar Supply Problem.

A note in *The Times* Weekly Edition, May 31, 1920, points out that the problem of securing a supply of fertilizers for Central Europe is under serious consideration by the Allied Governments.

The diminished stock of sugar in the world's markets is a serious problem in the general economical situation. With a view to increasing the supply of sugar, it is stated that definite arrangements have been made, on a limited scale, to assist Poland to buy fertilizers in return for an undertaking to supply the United Kingdom with a certain quantity of beet sugar next winter, which otherwise would be unobtainable. It is also suggested in some quarters that, if Germany could obtain supplies of fertilizers, she would be able to add considerably to the world's sugar supplies as the result of the coming beet crop.

Farmyard Manure.

Dr. Russell, Director of the Rothamsted Experiment Station, at a recent meeting of the Farmers' Club read a paper on 'Farmyard Manure—its Making and Use.' *The Field*, June 5, 1920, commenting on this paper says that, as was to be expected, it was concise and packed with information of practical value. The benefits and limitations of farmyard manure as a dressing for the land were described with understanding. Dr. Russell insisted that farmyard and artificial manures did not compete with one another; that they serve quite different purposes in the soil. 'No farmer,' he said, 'can do without artificials, no matter how much farmyard manure he may have at his disposal, and, conversely, no arable farmer, except in a few districts, would like to do without farmyard manure, even if he could have unlimited supplies of artificials at very low prices. The best results are always obtained on arable land by proper combinations of farmyard and artificial manures.'

The relationship of the two classes of manures is thus put briefly and correctly. They are complementary the one to the other, rather than competitive and alternative in their respective uses.

INSECT NOTES

THE OVIPOSITION OF THE CORN EAR WORM WITH REGARD TO ITS CONTROL.

The corn ear worm (*Heliothis obsoleta*, Hubn), or (*Chloridea obsoleta*, Fabr) is a very cosmopolitan insect, being found in most parts of the temperate and tropical regions of the w rld. It is also almost omnivorous, for it attacks a number of plants, generally preferring the fruits to the leaves.

It is known as a pest of tomato, tobacco, peas and beans in the United States. It also causes considerable damage to the cotton crop by feeding on the bolls, but it is chiefly as a pest of corn that it inflicts most damage to the farmer. It is in this connexion also that it proves to be a great pest in the West Indies

The following description of the insect, together with the illustrations accompanying it n from Ballou's Insect 'Pests of the Lesser Antilles' :—

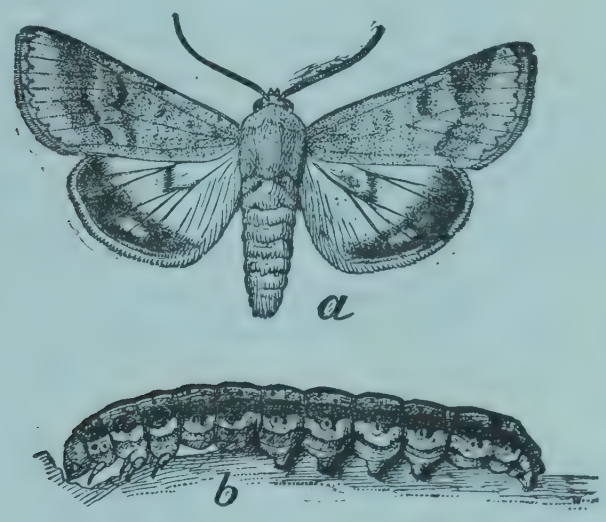

FIG. 7. CORN EAR WORM *(Heliothis obsoleta) (a) moth; (b) larva. Slightly enlarged. (From U.S.Dept. Agric)*

'The parent moth varies from a light to a dark grey in colour, and measures about 1½ inches across the outstretched wings. The female moth which flies in the dusk at evening, and at night, lays its eggs scattered over the food plant. The larvae vary much in colour and markings. The more common form is of a grayish-green colour on the side, with two darker stripes along the back, separated by a narrower light stripe The pupa is formed in the ground 2 or 3 inches below the surface, in a small earthern cell, within which the caterpillar encloses itself after feeding and growth have been completed. The life-cycle occupies about six weeks. The caterpillar, after being hatched, tunnels into the corn ear or cotton boll and destroys much of its contents.

'The eggs of the corn ear worms are laid singly, by preference on the silk of the corn. The caterpillars attack the ears by entering at the silk end. Here they eat the young tender grain, sometimes destroying more than half the entire ear. The nature of the damage they cause is shown in the accompanying illustration.'

Ballou states that the caterpillars of this species are carnivorous to a certain extent, for when two caterpillars come together in the course of their feeding, especially when in the ear, one is almost certain to kill and eat the other.

In the *Journal of Economic Entomology*, April 1920, there is an interesting paper on the study of the oviposition of the corn ear worm with relation to certain phases of the life economy, and measure of control. The author, James W. Mc.Culloch, Associate Entomologist, Kansas State Agricultural College, states that the major problems under consideration were (1) to determine the number of broods in the field, (2) the part of the corn plant selected for oviposition, (3) the relation of oviposition at the time of planting corn, (4) the relation of oviposition to the variety of corn grown.

FIG 8. CORN EAR WORM.

Showing mode of attacking ear of corn (From U.S. Dept. Agric.)

With regard to the first point, it appears that the number of broods during the season varies according to latitude, from one or two in Ontario to six or seven in Southern Texas. In Kansas it appears that the normal number of broods of the corn ear worm is three. The first brood usually begins to emerge during the first week in June, and reaches its maximum about June 15. The second brood appears about July 4. and is at its maximum about July 13. The third begins about August 10, and the maximum is reached during the last days of the month and the first days of September.

A single female is capable of depositing from 500 to 2,000 eggs, and as many as 570 may be deposited in a single night. The eggs are laid singly as mentioned above, and generally only one or two by the same moth on one plant. In ovipositing, the female lays from three to six eggs, hen feeds for a short period before resuming oviposition, this process being repeated through the night.

With regard to the second point, namely the part of the corn plant selected for oviposition, the studies at the Kansas Station emphasized the fact that the moths showed a decided preference for the silk of the corn on which to place their eggs, and that a corn plant was most attractive to them during the period of silking. The investigations also showed that a large percentage of the larvae entering the ear originated from eggs deposited on the silk. It became evident therefore that in the development of certain control measures it was neceesary to study the silking of the corn plant with special reference to the oviposition of the insect.

Under favourable conditions a corn plant remains in silk from four to eight days. Under conditions, however, of low rainfall and hot winds, fewer silks are produced, and many of the silks which do appear are destroyed within one or two days by the hot wind. Pollination is often prevented, delayed, or incompleted, and the silk may continue to grow to an unusual length, and may remain fresh for a much longer time. Observations show that any factor that influences silking has its influence on the number and location of the eggs,

A knowledge of the parts of the plants selected by the moths for oviposition is important in the development of certain measures of control. This is especially the case with regard to the times of spraying, times of planting, and with regard to varieties of corn as to their resistance to corn ear injury. Under normal conditions, when the corn plants produced the usual number of silks, the larger number of eggs were found on the silks. When silking was delayed or prevented by drought and hot winds, the upper surface of the leaves and the stalk were selected in preference to the other parts.

With regard to the third point, namely the relation of oviposition to the time of planting corn, it is observed that obviously the optimum date to plant corn with regard to the ear worm would be at such a time as to bring the corn into silk between the broods of the worm, and the conclusion is reached that under favourable conditions, in Kansas at least, the beginning of May is apparently the optimum time to plant corn so as to escape injury from the corn ear worm.

At to the relation of oviposition to the variety of corn, which was the fourth point for investigation, the results of the experiment seem to indicate that the principal factors to be considered with regaad to choice of varieties were the time and period of silking, the time of maturin ; and certain morphological characters of the plant.

THE FERTILIZATION OF CITRUS ORCHARDS.

For many years past the consideration of questions relating to the important citrus industry in California have received careful attention by the scientific staff of the College of Agriculture and the Agricultural Experiment Station of the University of California. In the annual report of the Director of the Experiment Station, for the year ended June 30, 1919, the results of experiments with regard to the fertilization of citrus orchards are recorded. These experiments, and the conclusions reached from them, seem worthy of attention to growers of citrus crops elsewhere.

These fertilizer experiments have been carried out on a uniform plan for twelve years. The results, judged by the yield and the appearance of trees, emphasize the great importance of organic matter and nitrogen in citrus fertilization, and the comparative slight importance, on Californian soil at least, of phosphoric acid and potash, in the opinion of Dr. Thomas F. Hunt, the Director. The plots treated with stable manure and raw rock phosphate, on which a leguminous cover crop is grown each winter and ploughed under in early spring, continued to show a superiority over those otherwise treated. Plots treated with chemical fertilizers, such as nitrate of soda alone, or in conjunction with sulphate of potash, superphosphate, and dried blood, have gradually deteriorated, showing increased quantities of mottled leaf, and are now much inferior to plots that have received organic matter. Nitrogen and organic matter therefore appear to be the most necessary requirements of the soil on which these experiments are carried out.

An experiment was started in 1915 for testing various methods of treatment in an attempt to rejuvenate a twenty-five-year-old run-down navel orange orchard. It is stated that in 1919 the mulched plots gave the highest yield, with an average crop of 203 lb. of fruit per tree, but the trees on these plots had not in general a healthy appearance. The plot with alfalfa hay worked in stands second in yield, with an average of 184 lb per tree, and the trees were not nearly so badly mottled as they were. Several other plots treated with various combinations of artificial fertilizers gave a yield varying from 175 lb. to 153 lb. per tree. Twelve stable manured plots, without additional nitrogen, gave an average yield of 142 lb. per tree, while eleven unfertilized plots only yielded 95 lb. per tree. The trees, however, which apparently have improved most in health, judging by their appearance, were those on a plot which received 20 cubic feet per tree of stable manure.

Repeated studies on the use of green manure in citrus orchards continue to emphasize the importance of the practice. Several species of leguminous cover crops continue to give most satisfactory results. Recent experiments have brought out the importance of using green manures in young citrus orchards to improve the soil while the trees are developing. In the 70-acre orchard, which was planted at the Citrus Experiment Station in the spring of 1917, an extra effort has been made to improve the soil fertility, as the land had been under grain crops for many years, and was much run-down. Black-eye beans have been grown between the tree rows each summer, and bitter clover (*Melilotus indicus*) sown broadcast over the entire area in the winter. The black-eye beans yielded the first year 720 lb. per acre of seed and about 1,000 lb. of straw, and the second year 1,837 lb. per acre of seed and about 3,000 lb. of straw. The sale of these beans more than paid for the cultivation of the orchard. Each harvest, after threshing, the bean straw has been returned to the land, applied uniformly in furrows about 12 inches deep, ploughed on each side of the tree rows, and the furrows filled in after the straw is applied

The winter cover crop was allowed to grow until the latter part of March, and then ploughed under. The first year this cover crop averaged about 19 tons of green material per acre, and the second year about 18 tons per acre. The orchard had no other fertilizer, but under this treatment has made a remarkable growth, even though an exhausted soil was used, and no application of manures of any kind has been made except the green manure grown on the land with the trees. The results illustrate the importance of using green manures in young orchards to build up the soil while the trees are young.

GLEANINGS.

A French authority states that sea-weed or sea-wrack possesses the desired properties for the production of a good paper pulp, and that it offers the following economical advantages. Besides furnishing a crop that is very abundant this sea-weed can be left to dry on the spot, and, before collection, cleansed by a rudementa ry shaking process. For transportation it can be put up in bales. (*The Board of Trade Journal*, May 20, 1920.)

It is reported that a patent has been issued to an American inventor for a pipe mixture composed of a combination of beet pulp and leaf tobacco. Under this process, it is asserted, the pulp is dried, roasted, and so prepared that it cannot be distinguished from tobacco in appearance, while the mixture has a most 'agreeable flavour.' It is not stated whether or not the inventor uses his own improved brand. (*Facts About Sugar*, May 22, 1920.)

The quantity of sugar exported from Barbados in 1919 was 50,719 tons, of which 11,552 tons were muscovado and 39,167 tons chiefly dark crystals. Of the total quantity 35,659 tons went to Canada, and 12,071 to the United Kingdom. The total qunatity of molasses exported was 8,922,356 gallons. Canada took in all 6,236,177 gallons, and Newfoundland 1,627,754 gallons, while 761,223 gallons went to the United States. (*Weekly Bulletin*, Department of Trade and Commerce, Canada.)

Jamaica is making rapid strides industrially: she is even constructing her own electric tram cars, which have been recently turned out by the West Indian Electric Co., Ltd. The speed capacity and the weight of the Jamaica made cars are the same as those of the imported cars, and they are considered likely to give even better service than the imported ones, for the reason that the wood used in foreign-built cars is held to be not wholly suited to a tropical climate. (*Pall Mall Gazette*, June 2, 1920.)

The example of some rubber manufacturers who have embarked upon growing rubber, may before long be followed by devoting attention also to increased cotton production. The present state of cotton supplies gives rise to grave doubts as to the immediate future, and points to a necessity on the part of the rubber industry to realize that in the matter of raw materials, manufacturers are almost as dependent upon cotton as they are upon raw rubber. (The *India Rubber Journal*, April 10, 1920.)

According to *Facts About Sugar*, May 22, 1920, the recently completed sugar-cane crop of Natal has resulted in the largest production of sugar ever recorded in that country. The production is stated to be in the neighbourhood of 185,000 tons of manufactured sugar, being an increase of about 30,000 tons over the crop of the preceding year. Practically all of the season's output of sugar, except some 12,000 tons for export, will be consumed in South Africa itself.

The *Nassau Guardian*, May 5, 1920, states that a grant of £800 has been recommended by the Committee of the whole House of Assembly of the Bahamas for the purpose of undertaking sponge planting in the Bight of Acklins. The experiments in sponge culture by the Marine Produce Board have been sufficiently successful to warrant further planting on a large scale, and the Bight of Acklins, which is a valuable sponge field, has been selected as the most suitable area for continuing the experiments.

In an article dealing with the culture of Hevea rubber in the Philippines, the *India Rubber World*, June 1, 1920, estimates that the total cost of developing a 2,500-acre rubber plantation in those islands is $500,000, or at the rate of $200 an acre. Such a plantation properly developed should, however, return a good profit on the investment. Because of the tremendous initial cost of development, rubber planting is stated to be primarily an undertaking for large capitalists.

American honey is becoming increasingly popular in Great Britain, the preference being given to Californian honeys, according to reports issued by the United States Department of Agriculture. In 1914 the total importations of honey by the United Kingdom were approximately 2,600,000 lb. By 1918 this had increased to 36,500,000 lb. of which the United States contributed more than any other country, its share being 16,000,000 lb. valued at $5,500,000. (The *California Cultivator*, May 22, 1920.)

On the authority of the *Sydney Morning Herald*, it is stated in the *Australian Sugar Journal*, April 9, 1920, that recent experiments disclose the fact that the water hyacinth contains a remarkably high percentage of potash, which can be extracted on a commercial basis. A manufacturing plant has recently been established on the Clarence River, where potash from water hyacinth is being produced for fertilizer purposes. It has been computed that the area of water hyacinth in Swan Bay on the Richmond alone, represented an amount of potash worth more than £15,000 at present day cost.

Among the many agricultural potentialities of Queensland, coffee growing, states the *North Queensland Register*, is certainly to be numbered, although that industry at present is not very extensively pursued. Some time ago it was said that certain samples of coffee which came from the Maryborough districts were the finest that had ever appeared on the London market. In the Herberton district yields from 2,000 to 2,700 lb. have been obtained per acre. In 1903 there were 62,027 lb. of coffee produced. Since then a decline in the coffee industry took place, until in 1910 it was practically at a standstill. Under the Federal Bounty Act, however, a bonus of 1*d.* per lb. was granted for eight years, and an import duty of 3*d.* per lb. on foreign coffee was imposed. Under these conditions the industry may revive. (*Chamber of Commerce Journal*, May 28, 1920.)

PROGRESS OF AGRICULTURE IN SOUTH AFRICA.

Owing to the financial situation created by the war, the publication of the *Agricultural Journal of the Union of South Africa* was suspended in August 1914. We are glad to welcome the issue of the first number of the *Journal of the Departmeut of Agriculture*, Union of South Africa, dated April 1920, issued by authority of the Minister of Agriculture, as the official organ of the Department.

The first article in this number is a review of the progress of agriculture in South Africa, and the important part played by the Department of Agriculture in this direction. The article is so full of interest that no apology is needed for making large extracts from it in the following paragraphs.

Real and substantial progress in agriculture in the Union has resulted in great agricultural prosperity, and is due, on the one hand, to the unlimiting efforts of the farmers of South Africa, and on the other, to the scientific work of the Department of Agriculture.

The agricultural progress of South Africa is shown by the increaseed production, decreasing imports, and increasing exports of farm produce, due for the most part to improved methods of farming.

For instance, in 1898, the year before the Anglo Boer war, there were imported into South Africa £3,500,000 worth of grain, meat, and other foodstuffs, and the value of agricultural exports (excluding ostrich feathers) amounted to £3,800,000, of which wool and mohair contributed £3,000,000. Against this in 1918, when population was greater, and prices much higher, the imports of similar foodstuffs had fallen to £2,165,317, while the exports of farm produce (excluding ostrich feathers) amounted to £17,610,042. Further, whereas in 1898 maize and maize meal to the value of £184,312 were imported into South Africa, the trade has now been reversed, and in 1918 there was exported £2,262,469 worth of these products. It is true that in 1918 exports benefited by the prevailing high prices, but, on the other hand, the oversea export trade suffered through lack of freight and of arrested production owing to scarcity of fertilizers, etc.

Dairying also has advanced. The days of individual and often haphazard butter-making have vanished, and co-operative dairying is rapidly spreading. In 1898 there were imported butter and substitutes to the value of £289,041, and cheese £98,433, but twenty years later £96,756 worth of butter and £25, 911 of cheese were exported, both of a high standard of quality

The same tendency is noted in all imports and exports; the one is steadily decreasing, and the other, both in quantity and quality, rapidly rising. No longer are imported huge quantities of meat; instead, the past few years have seen the commencement of what is probably going to be one of the Union's chief agricultural exports—meat.

Sugar is now an exportable commodity; formerly it was imported to meet deficient production.

In addition, several new products are coming to the fore. Tobacco growing is an important industry, and markets beyond the local one are necessary for the produce. A short time ago pigswere much neglected; now they are in great demand for bacon. The production of eggs (considered a small matter by the farmer with wide acres, but of much importance to many people and the country at large) instances also the spirit of progress, for instead of importing large quantities as in earlier years, local wants are supplied, and there is an appreciable surplus for export.

While the returns of imports and exports furnish a good indication, they do not fully disclose the progress that has been made. Farming has emerged from its old status, and is now on an entirely different plane. The majority of farms are fenced, and frequently sub-divided into paddocks, and superior farm buildings have been erected, while irrigation works and other permanent improvements are seen on all sides. Transport and marketing facilities improve yearly, and, above all, better methods of farming are practised. Individualistic and nomadic occupation has given way to settled organized industry.

The State has fostered and guided its agricultural industry systematically and thoroughly. At the outbreak of the Anglo-Boer war there were Departments of Agriculture in Cape Colony and in Natal, but in the Transvaal and the Orange Free State there were no organizations of this nature; in the two latter territories systematic control and organization of agriculture was introduced under Crown Government following the conclusion of hostilities. The Union Department of Agriculture is now organized on similar lines to those which characterized the late Transvaal Department, the latter having been modelled largely upon the United States Department of Agriculture.

When established, the present Department of Agriculture was found at the outset to lack scientific and technical officers, a great disability in the successful control of an industry like farming. The building up of a scientific staff was proceeded with, and though recently hampered by the war, its numbers are now nearly double what they were at the time of Union.

In many branches of farming the stimulus of the Department has been most beneficial. The remarkable progress of dairying has already been referred to. A share is claimed in the development of citrus and deciduous fruit culture and marketing, in the suppression of scab combined with the immense advance in the standard of the sheep and the sorting and packing of wool for market, in the information obtained through the researches of chemists, especially in soils and fertilizers, while the building up of a comprehensive library of agricultural literature places a wealth of knowledge at the door of all.

Probably one of the most useful and scccessful of all the Department's activities, and of unsurpassed importance in the country's advance, was the education of farmers through the establishment of schools of agriculture. The work allotted to these institutions is varied and far-reaching; the education given to students, the distribution of bulletins, the delivering of lectures and demonstrations given to farmers, and advice freely given have all added to the uplifting of agriculture. Another striking sign of the advance is the establishment of the Goverоment Faculties of Agriculture at the University of Stellenbosch and at the Transvaal University College.

Not without precedent in other countries, the spread of co operation in the Union has at times been chequered, but it is daily becoming more firmly established, and its helpfulness is spreading far and wide. The Department has aided in the establishment and supervision of many co-operative societies. Arising from the growing spirit of co-operation are increased production and improved quality, but, above all, is the gratifying sense of greater benefits which will follow the ever strengthening bonds of co-operation in the Union.

PLANT DISEASES.

RED RING DISEASE OF COCO-NUTS.

DISPOSITION OF INFESTED MATERIAL.

The bulk and nature of the stem of the coco-nut palm are such that the complete destruction of a well-grown tree, even of five or six years growth, is no easy matter, though the condition of infestation with myriads of nematodes in which the stem is found in a case of red ring disease, renders this obviously necessary in any attempt at prophylaxis.

With a view to an advance on previous practice, which has largely been to regard the sanitary disposition of the stem as impracticable, and to leave at least the stump to decay, the Imperial Commissioner of Agriculture some time ago suggested for trial in Grenada, a method based on the locally familiar operation of making charcoal.

It was recommended that the stem should be cut into short lengths, say, of 2 feet, by means of a crosscut saw; the use of the cutlass for this purpose would scatter too many chips. The stump should be dug out, as it is usually infected to the base, and the cutting should be done over the pit thus formed, in order to take care of the sawdust. The enlarged pit should then be used as a charcoal pit, the coco-nut leaves and bud, the sections of the stem, and a sufficiency of brush wood or other fuel being piled in the usual way. The heap should then be set on fire, and kept burning slowly under a covering of earth, and left for some time after it has burned out.

A report by Mr. R. O. Williams, Superintendent of Agriculture, Grenada, on a trial of the method, was later received as follows:—

'A tree which had died from red ring disease was dug out, the hole made in this operation serving with very little more preparation as a pit for the fire. Brush wood and other material were placed at the bottom.

'The tree was cut up into lengths of about 3 feet, each length being split longitudinally into five or six pieces, and placed in the pit in the same manner as for charcoal burning.

'The fire was started on Tuesday, April 27, and burned until May 7 (eleven days).

'The pit was opened on the eleventh day, and was found to contain nothing but white ash, with the exception of one small piece of charcoal and one piece of charred wood. These are being forwarded for examination.

'The total cost of destroying this one tree was 8 shillings.'

After a urther trial Mr. Williams reported:—

'One pit which I opened to-day was an unqualified success, all the material being burnt to ashes, except a few small pieces which were easily burnt when exposed to the air. The trunks become so thoroughly dry during this process that any pieces which are not actually burnt in the pit can be easily burnt in the ordinary way afterwards. The second one did not burn so well, but by next week I think that also will be totally demolished.'

No signs of life could be detected in the worms still visible in the centre of the charred piece referred to, and it is evident that with care the infected material can be successfully dealt with in this manner.

While the application of this method may appear formidable where large numbers of trees are dying, its results may be expected to be worth the trouble and expense entailed. Where the disease is only beginning to appear, it should be adopted at any cost. W.N.

MOSAIC DISEASE OF SUGAR-CANE.

A notable advance in our knowledge of the mosaic or yellow stripe disease of sugar-cane is made by a short paper contributed to the *Journal of Agricultural Research*, May 1, 1920, by E. W. Brandes, Pathologist for Sugar Plant Investigations, Bureau of Plant Industry, United States Department of Agriculture.

An account is given in the paper of experiments which demonstrate the transmission of the infection from diseased to healthy plants by insects and, to a limited and erratic extent, by inoculation with expressed juice.

The trials were made under strict control in greenhouses at Washington, and are the more reliable from being conducted away from any possible source of outside infection. The healthy plants used were from a stock of Lahaina cane maintained for six years at Washington without any sign of mosaic having appeared. The infective material was obtained from Porto Rico.

In the first series of experiments, sugar-cane, sorghum, and various wild grasses became infected from being grown in the close vicinity of diseased sugar-cane, the controls remaining healthy. The plants were infested with *Aphis maidis*, and a small leaf-hopper.

In the second series numbers of the corn aphis were transferred from diseased to healthy plants in insect-proof cages. Several definite cases of transmission occurred. The leaf-hopper failed to give rise to the infection, as did the sugar-cane mealy-bug.

In the third series (inoculation with juice of diseased plants) infections were obtained (1 in 10, 8 in 10) by injections with a hypodermic syringe. Other methods failed, except one case of inoculation by needle pricks.

It is inferred that the virus of mosaic disease of sugar-cane is highly infectious only when exacting demands in the matter of favourable conditions are satisfied. This agrees with field observations of erratic spreading controlled by some special conditions as yet unknown.

ITEMS OF LOCAL INTEREST.

DOMINICA. The crop from the lime experiment station during the month of June was 194 barrels of ripe limes Owing to the protracted drought, plant distribution is still held up, and for the same reason very little could be done in the Botanic Garden. The local price for ripe limes and lime products, Mr. Keys the Acting Curator, says remained unchanged Of the 1,922 camphor seeds sown, only about 200 have germinated up to the present time. The rainfall for the month was 3·48 inches.

MONTSERRAT. Continued drought seriously interfered with work in the Experiment Station, in June, and the planting of crops could not be undertaken. Continuous watering of young bay and lime plants was necessary to keep them alive. Five distillations of bay leaves were made, making a total of 5,000 lb. of leaves reaped from the experiment plot for the year to date. The plot has suffered severely from scorching of the foliage as the result of the drought, and the crop of seeds for planting is a failure. Regarding staple crops, Mr. Robson states that bolls of the cotton planted early in March have commenced to open, and the picking of the crop was begun at the end of June. There has been little opportunity for supplying irregular fields, and a considerable

area remains to be planted. Vegetable food crops promise to be very scarce in succeeding months. The newly appointed Cotton Inspector assumed his duties on June 1. During the month 107 silk-cotton trees were destroyed, making a total of 2,286 felled to date. The rainfall for the month registered at Grove Station was 2·55 inches. High winds prevailed at intervals during the month.

ANTIGUA. During the month of June plant distribution comprised 100 sugar-cane cuttings, 1 packet Casuarina seeds, 1 packet Eucalyptus seeds, 1 packet Olneya bean seeds, 1,266 lb. selected cotton seed. The total quantity of cotton seed sold to date is 2,741 lb. Mr. Gallwey the Acting Curator states that most of the labourers' time during the month was devoted to watering to try and keep plants in the Botanic Garden alive. The reaping of the island's sugar-cane crop is nearing completion. The young cane crop continues to improve under the influence of the light showers during the month. Up to the present time only a small acreage has been planted in cotton. By Proclamation, issued on June 16, the close season for District A (Yeptons and Five Islands) has been declared to be from July 1 to 31. Through the Acting Superintendent of Agriculture seeds of the Olneya bean were received from the U. S. Department of Agriculture. The rainfall for the month was 3·15 inches. The total precipitation for the year to date is 11·52 inches.

ST. KITTS. Mr. F. R. Shepherd, Agricultural Superintendent, states that the condition of the Botanic Station, owing to prolonged drought and small supply of water for watering plants is very distressing; many of the older trees are feeling the effects of the dry weather. Plant distribution during the month of June included 1 lb. of Mazzagua Guinea corn to Tortola, 369 lb. of yams sold for planting purposes, and 75 plants of *Casuarina equisetifolia*. The sugar factory will finish grinding in a day or two. The results are disappointing, as it is not expected to make quite 10,000 tons of sugar. Owing to the drought, the estimates made by the planters were not reached in most cases. The record return of canes per acre was 28 tons, plants and ratoons. Syrup making still continues in the northern district. The young cane crop is in a very parlous condition, and if heavy rains do not soon come, the prospects of a sugar crop for next season will be very gloomy. The ratoons especially are feeling the effects of the dry weather. Cotton picking has begun in the northern districts, but the plants are small, and the yield is low. Seed for planting from this source has been a boon to many who lost their first plantings by drought. This cotton was grown from seed supplied from the Government farm. In the valley district advantage was taken of the showers during the month, and most of the cotton was planted, The Government farm is also planted, and germination is excellent. Cockroaches have been troublesome on one estate, and much of the young growing cotton was destroyed by them. A mixture of Paris green and meal was used as a poison with success. The rainfall for the month was 3·50 inches; for the year to date, 15·23 inches.

AGRICULTURE IN BARBADOS.

On the night of the June 19, a very refreshing rain fell. It seems to have been a general one On Juue 22 there was another fine rain which was accompanied by a heavy mist; the Scotland districts also recorded a good rainfall.

It seems that the estates lying on the coastline have not been as fortunate in this matter as those further inland on account of the high wind pressure which carried the greater part of the rain clouds to the interior.

Planters are now very busily engaged in ploughing, and in digging cane holes. In the red soils the plough is now being put into action. So far very few cane holes have been dug, as the yam lands have not all been prepared. From some the field trash is being removed, and the cane stumps dug up before any yams can be planted.

A few fields of Indian corn are growing splendidly. The recent showers have done these much good. There does not appear to be any cultivation for potatoes. The land has not been moist enough to justify it. Continual showers will help to soften the soil for the retention of a heavy rain, when it may be possible to plant cuttings.

Cultivation of the land is now being rapidly extended as far as weather conditions permit, and with favourable weather, good tillage, and judicious manuring, it is hoped to that good yam and potato crops with result.

The cost of living problem still seems difficult, and everything possible should be done to hasten and increase the production of food stuffs.

The young cane crop has changed marvellously since the rain of June 7. This, of course, applies only to the major part. Certain fields in some locations have not responded well, and will not do so for some time.

The first ratoons, particulary the B.H.10(12), are now growing vigorously, and planters have been busy all this week applying chemical manures to their ratoons—in some cases even to plant canes.

The old cane crop has not yet been completely harvested. In several districts there are adult plant canes remain ing which probably will not be crushed before July.

Extension of reaping time is decidedly unfortunate. The quality of the juice becomes inferior, and much valuable work is delayed. This all has unfavourable results upon the sugar output.

The weather is, on the whole, much cooler, sunshine alternating with shower. Winds are strong, and even if they rob the soil of some of the moisture which they bring, yet they are cooling and refreshing to man and beast.

Fodder is still very scarce, but it is hoped that in a few weeks time the situation will have been much improved. More Para grass might well be planted; it germinates quickly, is hardy, and can be cut many times in the course of a year.

Potatoes are very scarce and are consequently dear.—(The Barbados *Agricultural Reporter*, June 26, 1920.)

DEPARTMENT NEWS.

Sir Francis Watts, K.C.M.G., Imperial Commissioner of Agriculture for the West Indies, returned to Barbados from St. Vincent by the R.M.S. 'Chaudiere' on July 5.

Mr. W. Nowell, D.I.C., Mycologist on the Staff of the Imperial Department of Agriculture for the West Indies, has accepted the offer of the post of Assistant Director of Agriculture, Trinidad, and will be leaving Barbados on July 21, to take up the duties of his office.

Mr. Nowell has filled the post of Mycologist on the Staff of the Imperial Department since September 1913. We wish him all success and prosperity in his new sphere of labour.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, June 10.

BALATA—Venezuelan Block, no quotations; West Indian Sheet, 4*s.* 3½*d.* c.i.f., spot, 4*s.* 6½*d.* to 4*s.* 7*d.*
BEESWAX—No quotations.
CACAO—Trinidad, 135*s.* to 140*s.*; Grenada, 100*s.* to 116*s.*; St. Lucia, and Dominica, no quotations; Jamaica, 115*s.*
COPRA—£53.
HONEY—75*s.* to 105*s.*
LIME JUICE—Raw, No quotaions Concentrated, no quotations.
PIMENTO—5½*d.*
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T. S. GARRAWAY & Co., July 6.

ARROWROOT—$8·00 per 100 ℔. duty paid.
CACAO—Lottings at 24c.
COCO-NUTS—$52·00 husked nuts.
HAY—Sales at $6·00.
ONIONS—Sales at $9·00.
PEAS, SPLIT—No quotations; Canada, Market bare.
POTATOES—Market bare.
SUGAR—Market bare.

London.—THE PERFUMERY AND ESSENTIAL OIL RECORD, May 17.

BAY OIL—27*s.* to 30*s.*
LIME OIL—7*s.* 9*d.* to 27*s.* 6*d.* for West Indian distilled, and for hand-pressed.
ORANGE OIL—West Indian, 35*s.*

Trinidad.—Messrs GORDON, GRANT & Co., May 5.

CACAO—Venezuelan, $25·70 to $26·00; Trinidad, $24 00. to $24·50.
COCO-NUT OIL—$2·35 per gallon.
COFFEE—Venezuelan, $5·50 per fanaga in bond.
COPRA—10½c. per ℔.
DHAL—No quotations.
ONIONS—$15·00 per 100 ℔. Light stocks.
PEAS, SPLIT—$10·00 per bag.
POTATOES—English, $8·00 per 100 ℔.
RICE—Yellow, $13·00 to $13·50. White, $14·00 per bag.
SUGAR—No quotations.

New York.—Messrs. HUTH, GILLESPIE & Co., Inc. June 18.

CACAO—Caracas, 19c. to 19½c.; Grenada, 18c. to 18½c.; Trinidad, 18c. to 18½c.; Jamaica, 13½c. to 14½c.
COCO-NUTS—Jamaica selects, $60·00 per M; Trinidad $55·00 per M; culls, Jamaica, $40·00; Trinidad $38·00 per M.
COPRA—9¼c. to 9½c.
COFFEE—Jamaica, 17½c. to 23c. per ℔.
GINGER—38c. to 40c. per ℔.
GOAT SKINS—Jamaica, Antigua, and Barbados, $1·00. St. Thomas and St. Kitts 80c.
GRAPE FRUIT—Jamaica, $3·00.
LIMES—No market.
MACE—36c. to 38c.
NUTMEGS—24½c. to 25c.
ORANGES—No Market.
PIMENTO—8¾c. per ℔.
SUGAR—Centrifugals, 96°, 21c.; Muscovados, 89°, 19¾c.; c. & f., Molasses, 89°, 19¾c.

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We can supply you with the above, selected from Seed grown at the GOVERNMENT INDUSTRIAL SCHOOLS, and the LUNATIC ASYLUM FARM, under the supervision of the Agricultural Department. Lint from this Seed has been highly reported on by the Spinners in England.

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May 15, 1920.

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St. Vincent: Mr. FLORIS SIMMONS, Ex[illegible]t Station.
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Montserrat: Mr. W. ROBSON, Botanic Station.
Antigua: Mr. S. D. MALONE, St. John's.
St. Kitts: THE BIBLE AND BOOK SUPPLY AGENCY, BASSETERRE.
Nevis: Mr. W. I. HOWELL, Experiment Station.
Canada: LEWIS W. CLEMENS, 801, Yonge Street, Toronto.

AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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Crop Production.

A paper on British crop production by Dr. E. J. Russell, F.R.S., Director of the Rothamsted Experiment Station, was published in *Nature*, April 8, 1920. Like all articles on agricultural subjects from Dr. Russell's pen, the paper referred to is one full of interest and instruction. Although dealing primarily with crop production in Great Britain, the points made and the conclusions drawn are applicable, *mutatis mutandis*, to crop production everywhere. No apology therefore is needed for drawing the attention of tropical agriculturists to Dr. Russell's paper, and for reproducing many parts of it in a condensed form in the present article.

Crop production is everywhere carried on in the hope of gain; it is in this respect different from gardening, which is commonly practised without much regard to profit and loss. Many poets have sung of the pleasures to be derived from gardening, but Dr. Russell says that he only knows of one who has sung of the pleasures of farming, and that was Virgil, nearly two thousand years ago.

The seeking for profit imposes the following important conditions on successful agriculture: maximum production must be secured at the minimum of cost. This condition is best attained by utilizing to the full natural advantages, and obviating, as far as possible, all natural disadvantages—in other words, by growing crops specially adapted to local conditions, and avoiding those not particulary suited to them.

From the scientific point of view the problem thus becomes one of adaptation, inasmuch as both natural conditions and crops can be somewhat altered so as the better to suit each other.

It is well known that plant breeders can alter plants within limits not yet defined. Of the natural conditions, however, determined broadly by climate and soil, the first must be regarded as uncontrollable, so that alteration can only be effected with regard to the second of these conditions. Thus, though plants may be altered and soils improved, the scheme of crop production in any country must be adapted to the climate, and especially to the rainfall.

There is no prospect of the consumption of the products of any agricultural crop being reduced, nor

would this be to the advantage of the agriculturist; his aim must be to increase his production in order to meet increased comsumption of his crops. Additional production may be obtained in two ways: by increasing the yield per acre, and by increasing the number of acres devoted to the crop. In both these directions there is a great difference in the average results obtained from good agricultural methods and poor ones. In two directions progress is possible: the plant may be modified the better to suit soil and climatic conditions, or the soil may be modified and improved so as better to suit the plant under existing climatic conditions.

Soil conditions can be profoundly modified by cultivation, which is an art, and not yet a science. The farmer or planter achieves the results by practise of the art, but no one can yet state in exact scientific terms precisely what has happened in the process of cultivation. Dr. Russell says that it is hoped to develop a science of cultivation at Rothamsted, but that for the present cultivation remains an art, and an essentially modern art. Mediæval agricultural implements were crude, and left the ground in an exceedingly rough condition. Throughout the nineteenth century great advances were made, and, given sufficient time and a sufficient supply of labour, a good planter or farmer using modern implements, can accomplish wonders in the way of cultivation. Unfortunately, however, neither time nor labour is always available in sufficient quantities. The early part of the life-history of a plant is of the greatest importance. Consequently, unless the planting of a crop is proceeded with at the right time of the year, the results of the harvest will certainly be disappointing. Hence the limiting factor of time in crop production. This often works adversely, owing to the other limiting factor, insufficiency of labour to get the work done within the proper time limit.

In both directions, time and labour, the internal combustion engine is proving a boon to agriculture, as it is enabling such cultural operations as ploughing, for instance, to be performed more quickly and more efficiently than by teams of horses or cattle.

Besides cultivation, in the sense of ploughing, harrowing, etc., the second great method of improving soil conditions is to add manures and fertilizers. Farmyard manure is more effective for this purpose than any other single substance; it is therefore likely to remain the most important manure, and, if available in sufficient quantities, it would generally meet the case of soil improvement. Farmyard manure, however, is not available in sufficient quantities to meet all requirements.

The chemist has long since come to the aid of the agriculturist in this direction. He has discovered the precise substances needed for the nutrition of the plant, and prepared them on a large scale. These fertilizers may be classed in three groups :—

Nitrogenous—nitrate of soda, nitrate of lime, sulphate of ammonia, and cyanamide (nitrolim).

Phosphatic—superphosphate, basic slag, mineral phosphate, guano, and bones.

Potassic—sulphate of potash, muriate of potash, and kainit.

Agricultural chemists have worked out the proper combinations of these fertilizers for most individual crops, and striking results have been obtained from the use of them. Without using any farmyard manure it has been proved that the yield of many crops can be maintained and increased. There is still, however, much to be learned about the proper use of artificial fertilizers; and it is possible that greater knowledge will conduce to still greater yields from the land in the future. By the use of artificial fertilizers it is certain that the yield of crops can be increased, but not indefinitely. In the case of wheat, for instance, the increase of the crop is limited by the strength of the straw. As the plant becomes bigger and bigger, so the strain on the straw increases, until finally, when the plant is some five feet high, it cannot stand up against the wind. At present the strength of the straw is the limiting factor in the improvement in crop production of wheat. Probably the plant breeder and the soil investigator between them will find a solution of this and other like problems.

In the old days when farmyard manure was the only manure, agriculturists had definitely to arrange for the keeping of a sufficient number of farm animals to maintain the soil in a proper condition of fertility. Hence there grew up a system of rotation of crops, one object of which was to provide sufficient food for farm animals throughout the year. This rotation of crops ultimately became a rule of husbandry in Great Britian, and has been advocated almost everywhere. It is interesting to find that Dr. Russell states that modern cultivation implements and fertilizers justify much more latitude, and that,

with the exception of a few crops, there is no more need to have a rotation of crops than there is to have a rotation of tenants in a house, provided of course that the fertility of the land is maintained.

There is much still to be discovered with regard to combination of crops best suited to particular conditions, but the work of such stations as Rothamsted and others is gradually solving problem after problem in the direction of increased production.

THE AGRICULTURAL OUTLOOK IN ST. VINCENT.

On his recent visit to St. Vincent, Sir Francis Watts, K.C.M.G., gave an address at the Court House on the Agricultural outlook of the colony, particularly with reference to sugar-cane, cotton, arrowroot, and food crops.

Sir Francis began by congratulating the colony on its improved agricultural outlook, and the promise of the prosperity before it. He said that St. Vincent was fortunate now in having more than one industry which might be regarded as being of a staple nature. Cotton stood first; arrowroot was an old and established industry; the making of syrup had assumed a degree of importance during the past two years; and there were a number of crops of lesser value, but which, in the aggregate, were of considerable importance, such as corn, ground nuts, cassava, provisions, and so forth. In this respect St. Vincent was better off than many of her neighbours.

Sir Francis then first dealt with the revived interest in cane cultivation. On this point he said that the cultivation of sugar-cane for the manufacture of syrup now offered some attractions, indeed it offered prospects of profits far in excess of what was formerly to be expected, or even hoped for from the manufacture of sugar. The cultivation of sugar-cane was attractive and desirable from an agricultural point of view; it was generally well understood in the colony, though it must be admitted that the manner in which it was carried on left much to be desired, when compared with the methods followed in several neighbouring colonies: there was room for great improvement in methods of cultivation and manuring, and in the general handling of the crop. Now that conditions have improved as regards the marketing of the produce, doubtless the necessary improvements in the field would follow.

It was probable that the manufacture of syrup was an industry better suited to the conditions of the colony than the manufacture of sugar. The manufacture of sugar called for the employment of large factories, which in turn necessitated the expenditure of large sums of money for machinery, and the provision of large areas under cane cultivation to supply the large quantities of canes which a modern factory requires for successful working. The configuration of the country, and the difficulties of transport, appeared to render the working of large modern sugar factories in St. Vincent a problem the successful solution of which was doubtful. Syrup, on the other hand, could be made with simpler appliances in smaller factories, and its manufacture seemed to be better suited to local conditions. There appeared to be springing up in various parts a steady demand for syrup at prices which compared favourably with the prices offered for sugar: there are eager buyers of this commodity and a ready market was secured. It is probable that this condition might continue for some time to come, for not only was there something in the nature of a sugar famine in the world at the present moment, but there was a tendency in some of the places where syrup was formerly made to adopt the methods of modern factories, and to make sugar instead of syrup. In these circumstances it would seem that there was an opportunity for places like St. Vincent to take advantage of the demand for syrup, and to produce that article in increasing quantity. If longer experience tended to show that the making of sugar in St. Vincent was likely to be more readily possible and profitable, the cultivation of sugar-cane for the manufacture of syrup would pave the way for a sugar industry, should there be anyone who desired to undertake the venture later on.

It was probable that the manufacture of sugar would prove quite remunerative at anything like the present prices obtainable, or even at something like one-half of those prices; but it was only reasonable to expect that these prices must soon fall—soon, that is, in comparison with the time which would be required to pay off the capital of a large modern sugar factory; so that any new sugar proposition must take this prospect into account.

It would seem that at the moment the making of syrup was more within the capacity of St. Vincent than the making of sugar in large factories, and would prove quite as remunerative.

It was most desirable that some sugar should be made in the colony, and it is to be hoped and expected that as much sugar will be made as to meet local requirements. The larger sugar industry is that which produces sugar for export, in competition with the great sugar-producing countries of the world.

With the extending cultivation of the sugar-cane, improvements in general agriculture might be expected. There would have to be improvements in the use of manures and fertilizers; probably there would be marked developments in the use of implements, including the use of ploughs and weeding machines, and, ultimately, the use of mechanical tractors. Attention too must be given to the use of improved varieties of sugar-canes; and this is a matter which might well have the attention of the Agricultural Department.

In connexion with sugar-cane, there will have to be renewed attention to matters connected with the pests and diseases of this crop. Here it may be noticed that a new form of cane disease has made its appearance, and has extended to the West Indies; it has been recognized in several places, amongst them Port Rico and Trinidad, so that restrictions have had to be imposed on the importation of sugar-canes, and it is hoped that these may be carefully observed, so as to keep the disease out of the colony. The disease alluded to is that known as the Mosaic or Yellow Stripe disease, because the first indication of its presence is the appearance of yellow or whitish patches or stripes on the leaves of the plant; later on the cane itself becomes affected, and the loss may be considerable. The nature of the disease is obscure; it does not appear to be due to insects, fungi, or bacteria; it is thought to be due to an infective virus, which may perhaps be carried from plant to plant by biting insects.

It is intended to reproduce other portions of the Imperial Commissioner's address in a future issue of this Journal.

RELIEF FROM SUGAR SHORTAGE DISTANT.

In its issue of June 26, 1920, *Facts About Sugar* publishes an article on the above subject, which is of general application to the prevailing conditions affecting the world's sugar supply, and should therefore be of interest, hence the following paragraphs are abstracted.

Conditions in the European beet sugar industry are of particular interest at the present time, because relief of the prevailing world shortage and restoration of a normal relationship between supply and demand depend in large measure upon the progress made by the sugar producers of Europe in getting back to, or toward, their pre-war level of output. During the earlier part of the war, many experienced sugar men held the view that the East and West Indies would shortly fill the gap caused by the depletion of the European sugar industry, and considered it doubtful whether continental sugar would find a market after the end of the struggle.

From the experience of the past three years, however, it appears improbable that the chief cane-growing countries can do no more by their utmost efforts to expand production than take care of the continuous yearly increase in demand. To fill the gap created by the war and consequent dis organization, Europe must resume the growing of sugar beets on a scale commensurate with the former proportions of the industry.

How long will it take the European industry to come back? The answer to this question will determine roughly the length of time during which the world's stock of sugar will be seriously below normal requirements. Nobody of course can answer the question exactly, because each crop is affected by a multitude of influences, some favourable and others unfavourable. If, however, the results of the past season and the outlook for the coming crop can be accepted as a guide, the process will require several years.

A preliminary estimate of Europe's 1920-21 sugar crop prepared by the *Journal des Fabricants de Suere* indicates a possible output of about 3,500,000 ordinary tons.

According to reports received, the European crop is beginning its progress under auspicious weather conditions. A favourable growing season, and particularly an improvement in the labour, fuel and transportation situations may advance the final yield another 100,000 to 200,000 tons, but at the best it is hardly possible to hope that it will exceed 3,350,000 metric tons or 3,750,000 ordinary tons. This would still be only about two-fifths of the total output in 1913-14. Maintenance of the same rate of progress would require five years to bring European production up to the level of 1912-14. We have yet to receive the opinion from any sugar man who has studied the suituation, that Europe's sugar industry can regain its pre-war position in five years. A full decade will be needed to accomplish this resnlt in the opinion of those who are best qualified to judge, and many of them hold the view that a still longer period will be needed.

It must be remembered that even before the war Europe produced rather less than its own requirements of sugar. While Germany and Austria-Hungary were able to export 1,500,000 tons, and Russia ocassionally was in a position to sell considerable quantities, the United Kingdom alone absorbed the exportable surplus of the Central Empires. The other continental nations either produced just about enough to supply their own needs, or were purchasers in the world's markets. Sugars from Cuba, Java, Mauritius and other producing districts regularly were drawn to European markets to eke out Europe's own supplies.

When it is considered that Germany, according to present estimates, will produce next season no more than half the amount her people were accustomed to consume before the war, that the component parts of the former Austro-Hungarian empire with the exception of Czecho-Slovakia, must import supplies, that Russsia has absolutely ceased to be a factor in the world situation, and that France anticipates a crop amcunting to less than 30 per cent. of her annual output prior to the German invasion, it is evident that none of the continental countries can contribute any very material proportion of the requirements of British consumers. Sweden, Denmark, the Netherlands and Belgium should supply their own needs with possibly something over, but the countries which are minor producers, such as Spain, Switzerland, Italy, and all south-eastern Europe must turn to outside markets for the greater part of their supplies.

Were Europe's economic handicap removed, and the nations of that continent placed in a position to bid on equal terms with the United States for the world's sugar, the contest for the forthcoming world crop would be of such proportions that it probably would send prices to much higher levels than they have yet attained. As it is, however, Europe probably will continue the rationing system of restricting consumption as a means of conserving its financial resources, and the American public will be able to obtain sufficient sugar to meet its necessary requirements without forcing prices above present levels. But the world shortage cannot be considered at an end until absolute freedom of sale and purchase is restored.

COLD VULCANIZATION OF RUBBER.

The following, reproduced from the *Manchester Guardian*, June 25, 1920, seems to point to possible great extension in the employment of rubber fabrics for various purposes, at a much cheaper rate in the near future.

The report that Mr. S. J. Peachey, lecturer in chemistry at the Manchester Municipal College of Technology, has discovered a process for the cold vulcanization of rubber, has been received by certain branches of the mauufacturing side of the rubber industry with much interest.

It is claimed that the new process is applicable not only to rubber in its ordinary forms as an elastic or plastic solid, but also to dissolved rubber, and that, being under complete control, it renders possible the production of a theoretically perfectly vulcanized rubber containing no free sulphur, and therefore not liable to undergo after-vulcanization or aging. In addition to securing greater durability, it is possible to introduce numerous delicate shades of colour which cannot be obtained under the old conditions. Leather waste, wood meal, and starch cellulose can, by means of the new process be mixed with rubber so as to yield cheap, fully vulcanized products with new properties and exceptional durability. In this way a new class of material to replace linoleum and other floor coverings can be obtained, largely from waste substances. The time required for the complete series of operations is about an hour; whereas the time taken up by the existing method of manufacturing machine-made floor-cloths is more than a month. Apart, therefore, from

the difference in the price of raw materials, the saving in time represents an enormous reduction in the cost of manufacture. Seventy per cent. of leather waste (buffings and shavings) mixed with 30 per cent. Of rubber is converted by the Peachey process into a substance possessing all the valuable properties of the original leather, together with the advantage of being waterproof. The process lends itself to the manufacture of hard-wearing leathers suitable for boot and shoe manufacture, as well as to the manufacture of delicately coloured and grained leathers for upholstery and fancy work. The reformed leather may be built into any desired article, and seams may be joined, and soles and heels attached by vulcanization. Stitching and riveting would thus be dispensed with.

Besides being a cold process, with the consequent elimination of the cost of steam, the process employs two gases which are by-products of several chemical manufacturing processes, and are available at a very low cost. In time also the process effects a considerable saving, the average mixing being completed in about a quarter of the time required by the hot process.

It is suggested that the process should be applied to the manufacture of cheap floor coverings, wall coverings, leather soles and heels with improved method of attachment, fancy leather goods, leggings and waders, hat leathers, motoring garments, belting, toys, dolls and moulded goods, motor tyre repair work, upholstery coverings and engineers rubber, and leather accessories.

But vulcanization is only one of a number of processes employed in the preparation of rubber materials for manufacturing purposes, and an improvement in that alone, however great, would not affect the industry to any drastic extent. If, however, the larger claim that the admixture of waste products with a small amount of rubber will produce, by means of the process, a material which will stand the test of wear and weather, and have the added virtue of cheapness, is substantiated by experience, the uses to which rubber may be put will be extended to a degree that is little short of revolutionary.

THE PRESENT STATUS OF LONG-STAPLE COTTON.

The *India Rubber World*, July 1, 1920, contains the following particulars in connexion with the present status of long-staple cotton, which should be of interest to cotton growers in the West Indies.

Some interesting information on the long-staple cotton of the United States is imparted by the Department of Commerce in *Bulletin No. 140* of the Census Bureau on 'Cotton Production and Distribution.' The years given are generally the 'growth' years for cotton, which lap over the following calendar year.

The need of long staple cotton for the manufacture of thread, automobile tires, and high grade fabrics has caused the demand to exceed the production. There was a time when the long-fibre Sea Island cotton grown in the West Indies formed the greater part of the cotton used in Europe; the whole world product of this variety at present, about 50,000 bales, is comparatively insignificant. The quantity of long-fibre cotton produced in Egypt last year was about 900,000 bales, and the quantity of upland and American-Egyptian cotton with a staple of $1\frac{1}{8}$ inches or more in length, produced in the United States, was 1,394,000 bales. Long-staple cotton is also produced in relatively small amounts in India, Brazil, Peru, and some other conutries. The amount of long-staple cotton, that is, cotton having a fibre of $1\frac{1}{8}$ inches or more in length, produced in the world in the growth year 1918 probably did not exceed 2.500 000 bales.

The Sea Island cotton crop of 1918 amounted to 52,208 bales or 20,450,000 lb. gross weight. being 40 411 bales less than the previous crop, and 65,351 bales less than the 1916 crop. The reduction is due to the ravages of the boll weevil and to the consequent reduction in acreage cultivated on that account. Where they stick to cotton, the farmers plant early maturing upland varieties instead of Sea Island, which takes long to ripen. The best Sea Island in the United States is grown on the islands off the coast of South Carolina; it is also grown in Georgia and in Florida.

The imports of Egyptian cotton into the United States in the fiscal year ended July 31, 1919, amounted to 100,006 bales of 500 lb. each, compared with 114,580 bales for 1918, 199,892 bales for 1917, and 350,796 bales for 1916. The demand for Egyptiau cotton led to its being grown in the United States, and its cnlture has been established in Arizona and California. The Department of Agriculture reports on its cultivation:—

'The production of American-Egyptian has greatly increased owing to the decline in the production of Sea Island cotton, caused by the ravages of the boll weevil in the south-eastern States. While not as fine as the best Sea Island fibre, American-Egyptian of the Pima variety is fully equal to most of the Sea Island crop in the length of staple and in average breaking strength. It seems to be a satisfactory substitute in making the classes of goods for which Sea Island was formerly used. The increase in the manufacture of automobile tires, and the difficulties in the importation of Egyptian cotton, point to a strong demand for American-Egyptian, and a corresponding increase in production.'

During the calendar year 1918, about 80,000 acres of irrigated land in Arizona and California were planted with this cotton, and the crop amounted to about 40,000 bales of 500 lb., which was sold at an average price of 56c.a lb. At least 80 per cent. of this was Pima, which has an average length of staple of from $1\frac{5}{8}$ to $1\frac{3}{4}$ inches. The average planted in 1919 is about 90,000 acres, nearly all located in the Salt River Valley, Arizona; and almost all of it is Pima.

The long-staple upland cotton was formerly grown only in the Mississippi delta. The increased demand has caused successful attempts to be made to grow it in other parts of the cotton belt. In 1918 there were grown 1,359,000 bales of upland cotton, $1\frac{1}{8}$ inches or more, as campared with 1,354,000 bales in 1917, 1,009 000 bales in 1916, and 833,000 bales in 1915. The increase in long-staple production is due, first to the high prices paid for it in recent years; and second, to improved varieties, which, on the right soil, are showing themselves equal in yield and in early maturity to the short-staple cotton. It was found 1·5 per cent. of the crop was over $1\frac{1}{4}$ inches in length, the percentage in Mississippi being 5·4. The yield per acre is put at 190lb. of lint above $1\frac{1}{4}$ inches in length, and 182 lb. from $1\frac{1}{3}$ to $1\frac{1}{4}$ inches, compared to the 157·5 lb. of short-staple under $1\frac{1}{8}$ inches. The long-staple varieties are grown only on better soil, and by farmers who give their crop special attention. The States which produced the most long-staple upland cotton in 1918 were Mississippi, Arkansas, Texas, and South Carolina.

THE SEA, A RESERVOIR OF MATERIAL.

Owing to the shortage of supplies not only of foodstuffs, but of many materials necessary for civilized communities—a shortage which is one of the results of the war—the question of how to increase production not only of food but of such things as leather, has become a world-wide problem of the greatest importance.

Considerable success has been obtained in most parts of the world in the direction of increasing the amount of products derived from the soil. It may be said that larger crops of vegetable products are being obtained to-day, and more extended areas are being devoted to their cultivation. Such vegetable crops can show easily an annual increase. The meat crop, however from which is derived most of the valuable ingredient in human diet, protein, cannot so quickly respond to efforts toward increased production. It requires time to produce animals fit for meat, especially beef. Considering also that from the same animals is produced such a necessary industrial material as leather, it would seem advisable to consider whether it is not possible to utilize another source of supply of protein in the diet, and leather in industries.

There does exist such a source of supply of food practically equivalent to meat in dietetic value, and at the same time of leather capable of being utilized for the same purpose as the skins hitherto employed. This supply is to be found in the fish—using the word in its broadest sense—of the sea, which may be had for the catching. The sea is a vast reservoir of food and other material produced without effort of man. It is for man to determine whether he will not make use of this source, especially now that deficiencies are appearing in the supply of what he has been accustomed to use.

With regard to fish as an article of diet, its value is essentially the same as that of meat and poultry Cooked fish of all kinds are approximately as rich in protein as beef, mutton, and chicken It is true that the quantity of fats present in the flesh of fish is, in general, less than that contained in meat. Fats can, however, be supplied to the diet from other sources, and can, to some extent, be replaced by starches and sugars, but the protein is the important constituent in food which exists in the flesh of fish as well as in that of animals.

An interesting paper by H. F. Moore, Deputy Commissioner, United States Bureau of Fisheries, published in the Annual Report of the Smithsonian Institution for the year 1917, draws attention to the sea as a food reservoir. He points out that it would seem as if the obvious way of increasing the supply of food from the sea would be to catch more fish of the kinds at present most in demand for food. This is not, however, so easy of accomplishment, owing, in large measure, to an inadequate supply of labour. Mr. Moore points out that on account of prejudice, there is a neglect or waste of enormous quantities of fish for food already being taken The United States Bureau of Fisheries is giving considerable attention to this subject, and has introduced some of the neglected fish foods into the market.

Sharks and rays constitute a group of fishes against which there is a widespread popular prejudice as to utilizing their flesh for food. This prejudice is probably based on the reputation which these fish have as 'man-eaters'. As a matter of fact there are no man-eating sharks in the sense that they generally or even frequently feed on human beings. There are a few cases now and then of men being injured or killed, and perhaps partially devoured by some of the larger species of shark. Such instances are, however, rare. The food of sharks in general, for there are very many species, is like that of other carniverous fishes Some feed on crustacea and other animals living at the bottom of the sea, and some confine themselves to feeding on smaller fish. Usually they are clean feeders, although when hungry they may not be so particular.

Sharks are eaten in many parts of the world frankly as sharks. In the West Indies some of the smaller species, and especially their young, 2 or 3 feet long, are frequently eaten by the fishermen and others. The flesh is white and flaky, and when dressed, is as palatable as the flesh of such larger fish as cod. The paper referred to above states that considerable quantities of moderate sized species of shark enter the New York market, where most of them are sold fresh as 'sturgeon', 'deep-water sword fish', or otherwise under the guise of species more generally known to the public. Mr. Moore states that one of the smaller species of shark has been on the market smoked and canned for about a year, under the name of 'grayfish', though it was previously known to American fishermen as the 'spiny dogfish.'

Most of the rays, probably all of them, Mr. Moore says, are edible, and some are highly regarded in many parts of the world. The great wings or fins are the parts most used, being left yoked together by the pelvic girdle, after the head, body and tail are cut away. The two connected wings are knownas a 'saddle'. The flesh is white, flaky, and of excellent flavour.

There has recently been developed quite a demand for whale meat. The shore whale fisheries of the Pacific Coast have been carried on for a number of years for the production chiefly of oil. The flesh of the whales caught, when not converted into fertilizer, was thrown away. Now after having been placed on the market for food purposes in 1917 its excellence has created a demand to satisfy which the supply is not sufficient. It may be mentioned in this connexion that some years ago, when there was a small whaling fishery located at Barbados the flesh of the whale was also largely used in the island for food.

The foregoing paragraphs have dealt with the question of hitherto neglected sources of food obtainable from the sea But, as was mentioned before, there are other materials which the denizens of the sea can supply in large quantities for use in industry. Leather is perhaps the most notable of these. It has only been within the last few years that processes for satisfactorily tanning and treating the skins of large fish like sharks and rays, or the hides of whales and porpoises were perfected. This industry is now attaining considerable proportions on the coasts of the United States and in other parts of the world. The United States Bureau of Fisheries has invented and perfected a special seine net of very strong twine mesh, which is used in capturing sharks porpoises, rays, etc. on the coast of the South-eastern States These creatures are skinned, and the hides are turned into excellent leather which is stated to be suitable for any purpose for which leather is used. Considerable success also seems to have been attained in the conversion of the hides of various species of whales caught along the coast into serviceable leather.

AGRICULTURAL POSSIBILITIES OF THE FIJI ISLANDS.

An article appeared in *United Empire*, June 1920, n which it is stated that the Fiji Islands afford an excellent opportunity for Empire development, and form an ideal possession from a colonizing standpoint.

The land is said to be extraordinarily rich and productive. At present the chief crops of Fiji are sugar-cane, bananas, coco-nuts, tobacco, rubber, rice, sisal, and maize.

Sugar-cane cultivation and sugar manufacture have been exploited on a large scale.

The cultivation of sugar-cane is carried out on scientific lines. At each district centre in Fiji, experimental laboratories are established for scientific research. New canes are annually produced—usually the outcome of a system of hybridization—richness in sugar being the object aimed at. Soil analysis is another item which receives great attention in sugar-cane cultivation.

As a proof of the richness and productive qualities of Fijian soils, it is mentioned that a certain field of virgin soil, after five operations of tilth, namely (1) breaking up with single-furrowed ploughs, (2) cross-ploughing with disc-plough, (3) planting with Mauritius bean, (4) ploughing in of the bean when full-grown, and (5) drilling, gave a first crop of 50 tons of cane per acre as an average. This field was a 'pocket' or 'lead', from a river-flat up into the hills. Another field on alluvial flat land gave a return of 56 tons per acre after three operations of (1) breaking up, (2) cross-ploughing, and (3) drilling.

The question of pests of the sugar-cane is briefly dealt with, the chief mentioned being the Fiji blight and the borer, which have been fairly successfuly handled by the Experiment Stations. The problem of labour, a supply of which has to be sought for outside the island, is then discussed, and the writer of the article, Captain G. S. Kingsell, goes on to say that at the present time, when the question of absorbing the vast number of unemployed soldiers and sailors is all important, he does not hesitate in suggesting action on the part of the Government in the direction of stablishing farms in these islands, and settling thousands of men in a congenial and profitable occupation. The field for enterprise is immense, and careful enterprise on behalf of the Government would not only result in a solution, to a great extent, of the unemployed problem, but would lead to a wide development of an Empire asset. The present shortage of sugar also justifies a move towards the greater production of this commodity. There are many suitable areas in Fiji that are adaptable to a big scale of operations. The big sugar-producing companies at present operating would welcome a Government-supported scheme for the growing of sugar-cane. The companies want the cane no matter who grows it, and they would hand over large areas of cultivated land to provide a nucleus of a scheme for the settlement of soldiers.

The tropical climate of Fiji, Captain Kingsell states, does not preclude white men from working there. White men work as hard there as any black man, if not harder in certain occupations. The drivers of locomotives, platelayers, and bridgebuilders on railways, engineers, boilers, fitters, and the hundreds of mechanics in and around sugar mills toil daily in circumstances less congenial than labouring in the open in a cane field.

Owing to the geographical formation of the Islands, the most productive land lies along the coast and in river valleys. From the seashore the country rises quickly to mountains in the interior. The slopes of intervening hill-lands are usually covered with jungle, or dense reeds of bamboo species. However, the country, when cleared, produces excellent grass for the feeding of sheep and cattle. At present the cattle industry on one island especially, that of Taviuni, is well advanced; but not so in the case of the larger islands, owing to the industry not having ready access to markets.

It would seem that transport is the keynote to success of any enterprise in the Islands. At present the communication between Fiji and the outer world is very limited, being confined to the regular services of the Vancouver-Sydney mail steamers, and of two colonial companies which send a steamer once monthly on round trips to the Islands.

The hill-lands mentioned above are suitable for cattle and sheep rearing, owing to their ideal climate, their excellent drainage, which obviates the possibility of foot-rot, and the natural grasses, which provide perennial feed that excludes any necessity for hand feeding. The wool obtained from the sheep, although not produced in such quantity as in colder countries, is of good quality and fine texture, and the huge quantity of frozen meat annually shipped from various other parts of the world to Europe proves that a market is ever available for beef and mutton.

Successful coco-nut and rubber plantations are to be found throughout the Islands. The present high prices of copra and rubber make these products very profitable ones. Many plantations are to be found with coco-nut and rubber trees interspersed with sisal (from which hemp is manufactured) growing on the poor lands, and tobacco in many cases on the higher lands.

Ranking second to the sugar industry is that of the banana. The fruit is cut when green and punted down the rivers to the market, where shippers take it over, having agreed as to purchase-price on the plantation. The fruit is mostly shipped to Sydney, Melbourne, and Auckland. In Fiji the banana grows readily and does not need much attention. Keeping the plantation clean in the vicinity of the trees when young, is the chief essential.

Maize cultivation is also another remunerative and profitable industry. River flats have been known to produce three crops in one year.

Pine-apples also grow readily in Fiji, and would be likely to prove a profitable industry, were access to markets available. Papaws lemons, oranges, and mandarines, all grow in a semi-wild condition, and if cultivated, would probably pay, could the fruit be marketed at reasonable prices.

In conclusion, Captain Kingsell writes that a country with all these attributes and possibilities is worth developing. It is simply a question of ways and means. The chief drawback at present is the lack of water-transport. Two of the steamers now used for this purpose are large, and specially built to carry sugar and molasses, the latter is mentioned as a profitable by-product from the sugar-mills; but, even with the large shipments made to Sydney, large surplus stocks of this product are often dumped into the sea. This further points to the necessity of developing the present shipping facilities. Captain Kingsell states that the idea of Imperial assistance to colonial industry is not novel; it would only be a continuance of the policy adopted by the Imperial Government when they subsidized the central sugar factories at Antigua and St. Kitts. These factories have proved successful. He draws the attention of the Imperial Government to these smaller oversea possessions, and their possibilities in regard to developing the Empire, and absorbing numbers of unemployed.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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†Provided by the Imperial Department of Scientific and Industrial Research.

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NOTES AND COMMENTS.

Contents of present issue.

The editorial points out some directions in which progress may be attained in increased crop production.

Under Insect Notes, on page 234, will be found an article which shows the necessity for strict quarantine for the prevention of the introduction of insect pests from abroad, as instanced in the case of the green Japanese beetle in the United States. Under the same heading is a note on cacao thrips in Surinam.

The sea as a reservoir of material, especially leather, is the subject of an article on page 230.

The agricultural outlook in St. Vincent, chiefly with regard to the revived interest in sugar-cane planting, is dealt with on page 227.

An article on the selection of stocks for citrus planting will be found on page 235.

Tropical Zoological Research Station in British Guiana.

The New York Zoological Society began research work in British Guiana in 1916. Owing to the difficulty of transportation at the time of the war there was a lapse during 1917, but work was resumed in 1918 and 1919. A fourth year's work at the station has just been commenced, again under the direction of Mr. William Beebe, Honarary Curator of Birds at the New York Zoological Park.

An article on the Station published in *Science*, June 11, 1920, states that the distinctive research feature of this station is intensive biological observation in one region, in fact in one locality. The locality chosen by Mr. Beebe is in Bartica District, British Guiana, at Kartabo, the point of junction of the Mazaruni and Cuyuni Rivers, on the eastern edge of the tropical rain forest of South America, which extends unbroken over a great part of the Continent. The locality has proved an ideal one as a permanent site for the Station. Within ten minutes walk are sandy and rocky river beaches, mangrove swamps, grass land, and high forest, each with a growth of life peculiar to itself. Free exposure to the trade winds, the absence of flies and mosquitoes, and invariably cool nights, all contribute to the unbroken health of the scientific staff.

This region affords opportunity for studying the fauna and flora in their independent and interrelated adaptations in all grades of life, in vertical as well as horizontal life zones. The vertical division of the fauna and flora in distinctive zones, extending from the tree summits to the subsoil, is a biologic contribution of importance. The observations of the Station staff extend from colour and adaptation to anatomical and functional characters of all forms of life.

Many valuable papers have already been published on the scientific observations of the members of the Station staff, and the publication of others may shortly be expected.

New Site for the Louisiana Sugar Experiment Station.

In a previous issue of this Journal attention was drawn to the fact that, owing to notice by the Audubon Park Commission, the well-known Sugar School near New Orleans would be obliged to find new quarters.

A committee was appointed by the Louisiana Planters' Association to select a new site for the Station, the only restriction as regards such selection being expressed in a resolution that the site selected should be near New Orleans.

The *Louisiana Planter*, May 8, 1920, states that the committee finally selected a tract comprising some 30 acres, within thirty minutes distance by the electric tram line from the centre of New Orleans. The tract is good land, a part of the old Soniat plantation, and was offered to the committee at a reasonable price. An

agreement was entered into with the present owners for the transfer of the property, which was to take place as soon as the necessary legal formalities were complied with.

It is hoped that the famous Louisiana Station will continue to prosper in the future on its new site, as it has done in the past on the old one.

Cambridge Degree in Horticulture.

Apart from the question of supplying instruction and advice to market gardeners, in view of the fact that many men are settling on the land in England in that capacity, it is desirable that fruit farmers or market gardeners should be able to obtain instruction in horticulture, as scientific and comprehensive asthat which can be obtained nowadays in agriculture.

The Field, June 19, 1920, states that, in order that such instruction may be available, the Ministry of Agriculture has made it possible for the University of Cambridge to establish a degree in horticulture, and a post-graduate diploma. The course for the degree will extend over three years, and will consist of instruction in the theory and practice of commercial fruit and vegetable growing, the practical side of the subject being treated no less fully than its theoretical aspect. It is hoped that the course for the post-graduate diploma will provide men qualified for research work in horticulture.

Both the courses mentioned above will commence in October next.

Rubber Growers' Association Prizes.

A note appears in the *India Rubber World*, June 1, 1920, in which attention is directed to the fact that the Rubber Growers' Association, Inc., London, offers prizes amounting to £5,000 for new ideas, and for encouraging new uses of rubber; a first prize of £1,000, three prizes of £500, and ten premiums of £100 each. A sum of £1,500 in addition will be divided among other competitors who may offer ideas of value. Suggestions must be in by December 31, 1920. They must be practical, and likely to increase the demand for the raw material.

Competitors are required to give: (1) a brief description of the idea; (2) a full, detailed description with explanations, samples, diagrams and designs, so as to make it possible to work out the idea; (3) a statement of the facts on which the idea is based, and of the special advantages the competitor has had for acquiring his knowledge; (4) any available information about cost, demand, and the quantity of raw rubber likely to be needed; (5) whether the idea is partly or wholly original or not; and (6) whether it is covered in any way by patents, or if patents have been applied for.

Entries should be addressed to The Rubber Growers' Association Prize Competition, care of Fitzpatrick, Graham & Co., 95a Chancery Lane, London, W. C. 2

Industrial Exhibition in St. Vincent

On June 30 an industrial exhibition was held at the Court House in Kingstown, St. Vincent, under the patronage of the Acting Administrator, and under the auspices of the Imperial Department of Agriculture.

The exhibition appears to have been an unqualified success, and Sir Francis Watts, the Imperial Commissioner of Agriculture, expressed satisfaction with the whole exhibition, and heartily congratulated the Administrator and the people generally on this new movement.

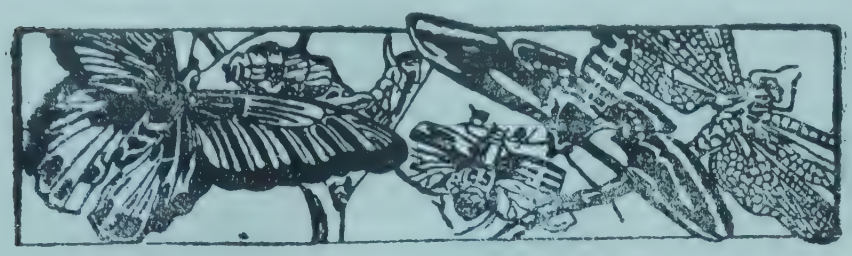
Numerous prizes were awarded in various classes. A diploma of special merit was awarded by the Imperial Department of Agriculture to the St. Vincent Electric Light Company, Ltd., for an exhibit of fine table oil, produced at their cotton factory. The bookbinder of the Government Printing Office was awarded a similar diploma for his exhibit, and Messrs. C. Adams, photographer, H. Mc. Dowall, shoemaker, and S. S. Garrett, joiner, were also recipients of the diplomas for articles exhibited by them.

Perfumery Industry in Australia.

According to the *Perfumery and Essential Oil Record*, June 1920, two retired officers, after having served in the forces of His Majesty during the war, are now becoming the pioneers of a perfumery industry in Australia, and are establishing one of the first perfumery farms and factories in the Commonwealth. They have obtained land on the Hawkesbury River, New South Wales, which has very many similarities to the land in the neighbourhood of Grasse, the headquarters of the French perfumery industry. They intend to plant lavender, geranium, peppermint, and roses. Preliminary experiments have shown that high class oils can be produced. Japanese mint (*Mentha arvensis*) has been cultivated, from which as high a proportion of free menthol has been obtained as from anywhere in Japan.

Being located in a district where citrus cultivation is carried on, it is also intended to buy up the 'culls' from the citrus orchards and to treat them for obtaining citrus by-products, including orange and lemon oils. Certain eucalypts will also be treated for the production of oils, such as *Eucalyptus citriodora*, *E. Macarthuri*, and *E. staigeriana*.

Owing to war conditions the supplies of many essential oils to the perfumery trade have become very limited. Extensions of production in this direction, such as that mentioned above, will doubtless be welcomed by the trade.



INSECT NOTES

THE GREEN JAPANESE BEETLE.

The extreme stringency of the present plant quarantine legislation in the United States of America is sometimes a subject of not very flattering comment. The wisdom of such legislation has, however, been demonstrated over and over again. Had the strict quarantine laws of the present been enforced in the past, many valuable crops would have been saved, and the expenditure of large sums of money would not have been necessary for the purpose of control of imported pests and diseases of plants. For it is remarkable that imported pests are often responsible for more damage to certain crops than indigenous ones, controlled, as these latter usually are, by native enemies

An instance of the rapidity with which an imported insect pest may spread, and the difficulty and expense of eradication or control, is given in an article in the *Journal of Economic Entomology*, April 1920, on 'The Green Japanese Beetle Problem,' written by John J. Davis, Riverton, New Jersey, much of which is reproduced below.

The green Japanese beetle (*Popillia japonica*, Newm.), a native of Japan, was introduced into the United States at Berlington county, New Jersey, probably five or six years ago, presumably in the grub stage in soil about the roots of imported plants.

The rate of its increase has been remarkable. When first noticed in 1916, only about a dozen beetles were found after a careful search, while in 1919, in the same locality and at the same season, one person has collected by hand 15,000 to 20,000 beetles in a day, and in favourite places the grubs are as numerous as 250 to the square yard. The area of infestation has increased from approximately 600 acres in 1917 to 15,000 acres in 1919, and it is considered that the beetles were at least ten times mors abundant numerically in 1919 than in the previous year.

After some study of the life-history and habits of this insect, the Bureau of Entomology with the co-operation of the New Jersey State Department of Agriculture, planned to take active steps to control, and, if possible, to eradicate the beetle.

The work undertaken for this purpose cost $15,000 in 1918, and its continuance in 1919 cost $35,000 more. It was then decided that the policy of eradication must be abandoned, but that a vigorous policy of control should be inaugurated, which, it was estimated, would call for an additional minimum expenditure of $70,000, to prevent the further spread of the insect, to discover practical control measures, and to attempt introductions of its natural enemies from Japan.

The difficulty of control is due to the life-history and the habits of the beetle. The total life-cycle is one year, most of which time is spent in the soil as an egg, larva, or pupa. Having passed the winter in the soil some inches below the surface, the almost full-grown larva returns to near the surface in spring, and resumes feeding. By early June the larva is transformed into the pupa, and about two weeks later the adult beetle emerges. The life of the individual beetle averages from one to ten weeks. The female beetle lays her eggs preferably in uncultivated places, such as grassy and weedy areas along roadways, in moist but not swampy ground, each beetle laying an average of sixty eggs. The young grubs feed on decaying matter in the soil, and to a less extent on living plant roots. The adult beetles are practically omnivorous, strong fliers, and exceedingly active on warm sunshiny days.

In the larval stage the beetles are not injurious, because they feed more freely on decaying matter than on living roots. The adult beetle is, however, a serious menace to small fruit, cereal and forage crops, orchard trees, and ornamental plants. As was stated above, it is almost omnivorous; more than 120 kinds of plants have been recorded as damaged by it. The beetle does not defoliate the plant, but rather skeletonizes the leaves, which often turn brown and drop off. There is every reason to believe that injury to several crops by the attacks of this beetle may acquire considerable importance.

It is stated that the insect is not a pest to any great extent in Japan, although it does occasionally damage grapes and soy beans, the latter especially. The fact that it is of little importance in its native home, only indicates that it is there held under reasonable control by natural conditions or natural enemies, or both It would appear, however, that the species can very easily become a pest of prime importance to the agricultural interests of any community where it becomes established, unless held sufficiently in check by natural enemies.

For several reasons the control of this insect presents a considerable amount of difficulty. In the first place the beetle, though small, is a strong flier, very active, easily carried in vehicles, on persons, and on marketable foodstuffs, flowers, etc.; in the second place it feeds on a large variety of plants, including low-growing ones, up to the largest timber trees; in the third place it spends the greater part of its life under ground, where it is difficult to reach; and in the fourth place, because, multiplying with remarkable rapidity, it lacks native natural enemies. Another difficulty in the control of this insect is because the beetle is only moderately affected by poison, and is strongly repelled by almost all arsenicals. The prevention of its spread is certainly difficult, but not impossible, and it is believed that, with the plans at present under way, and a strict quarantine of the infested districts, together with the co-operation of all residents in the area, another season will show its spread to have been appreciably decreased.

This beetle apparently is not as yet known in the West Indies, but, from its appreciation of bright sunny weather and warm days, it would seem to be an insect that if introduced might well flourish in these islands. Fortunately in nearly all the West Indies, the plant quarantine legislation is quite sufficently strict, if enforced, to keep out such undesirable aliens as the Japanese green beetle.

CACAO THRIPS IN SURINAM.

The Agricultural Department in Surinam has recently issued a pamphlet, No 16, on the control of cacao thrips in that Dutch colony. As the subject has received considerable attention of late both in Trinidad and Grenada, the following abstract of the pamphlet referred to, which in its original form is in Dutch, will doubtless be of interest to cacao planters in the West Indies.

Thrips damage can be prevented by spraying the

undersides of the leaves with Bordeaux mixture or milk of lime. A trial plot gave on a count five and a quarter more pods per tree than an unsprayed plot. It is particularly valuable for the production of young cacao.

The injury attributed to thrips in Surinam can be very severe, leading to successive defoliations and die-back, and even death outright, while production is greatly reduced.

Notable damage ensues from infestations which do not exceed an average of three insects per leaf, the effect being consequent not on the direct injury, but on its results in causing premature defoliation.

Spraying should begin after the cessation of the heavy rains, in July or the first half of August in normal seasons. The application should be repeated when new leaves have appeared in quantity, and require protection. Two sprayings should suffice for old, and three for young trees.

Bordeaux mixture gives the better covering, and lasts longer; but milk of lime is cheaper, and endures for at least six months It is best prepared from fresh lime, and needs to be actively stirred during use.

SELECTION OF STOCKS FOR CITRUS PLANTING.

As is well known, the citrus industry of California is a very important one. A great point is made there by citrus growers of marketing only standard varieties of the citrus fruits grown, which are also carefully graded.

It is pointed out in a paper by Herbert John Webber, published as *Bulletin No. 317* of the Agricultural Experiment Station, Berkeley, California, that citrus growers have observed great variation in the yield of different trees in the same orchard. This variation occurs even in orchards all of the same variety, planted with the best obtainable budded stock. Some orchards in which all the trees are quite uniform in growth, yet show a variation in yield among the individual trees. Other orchards are irregular in growth, containing many trees that have grown unsatisfactorily and slowly, mixed with others that are somewhat better, and still others that are vigorous trees which yielded well.

Now it is of the highest importance as regard financial profit that every tree should be a good producer.

The importance of taking buds from trees known to be productive, and true to type, is generally recognized. The use of buds taken indiscriminately, except for the precaution that they were from trees of a known variety, is responsible for much of the variation in production as well as in type that occurs in orchards. This is, however, probably only one of several factors that need to be considered.

The variations in yields of trees budded with the same variety in the same orchard, planted at the same time, and cultivated and treated as nearly alike as possible, are likely to be due to one or more of the following factors: (1) to variations inherent in the buds selected—as was noted above this is well recognized in practice by citrus growers; (2) to different kinds and characters of stocks used; (3) to the character of the union obtained in the budding or grafting; (4) to differences in environment, especially as to soil, under which the trees are growing; and (5) to accidental and unavoidable differences in the treatment given to different trees.

The influence of the character of the stock on this variation is considered by Mr. Webber to be very important and fundamental. He states his belief, however, that while both the nature of the bud and of the stock is important, all the variation in yield found in orchards are not certainly due to either of these two factors. The other factors mentioned doubtless have also an important influence on the yield of different trees.

After having been hatched in a seed bed, when the time of transplanting into the nursery arrives, the seedlings are usually found to vary greatly in size, ranging from a few inches to a foot or more in height, and this variation invariably occurs. When the time for budding arrives there is again remarked a considerable variation in the size of the seedlings, so much so that only the largest ones have reached sufficient size to be budded, and those that are too small are allowed to grow on, and are budded later on when they have reached the desired size. This variation in size seems to continue through the lifetime of the tree It has been asserted that the small tree, which requires a much longer time to reach the required size for transplanting and budding is as likely to become a good, productive tree in the orchard as the vigorous-growing one that reached the required size at an earlier period. In Mr. Webber's opinion, however, this would seem to be unlikely, although he does not think that there is evidence enough available to reach a positive decision

In the Bulletin referred to there is a full account of many experiments made on standard varieties of orange and grape fruit, which shows that after two and a half years in the orchard the large trees remain large, the intermediate remain intermediate, and the small remain small. This appears to indicate that, in planting orchards, only the large nursery stock should be used. And the conclusion is reached that budding on seedling stocks of different types and unknown character of growth is believed to be largely responsible for many of the irregularities in size and fruitfulness of orchard trees The following practical recommendations conclude Mr Webber's paper:—

1 No longer must stocks for budding be grown indiscriminately from any kind of seeds. Seeds should be used only from fruit of selected trees of good, vigorous growth and type.

2. When being transplanted from the seed-bed, all small individuals should be rigorously discarded. It may be estimated that in ordinary lots of seedlings about 50 per cent. should be discarded immediately, and not planted in the nursery Seedlings, however, are worth but little and have cost little trouble; consequently this is the period to do severe selection, which may be recommended as good policy.

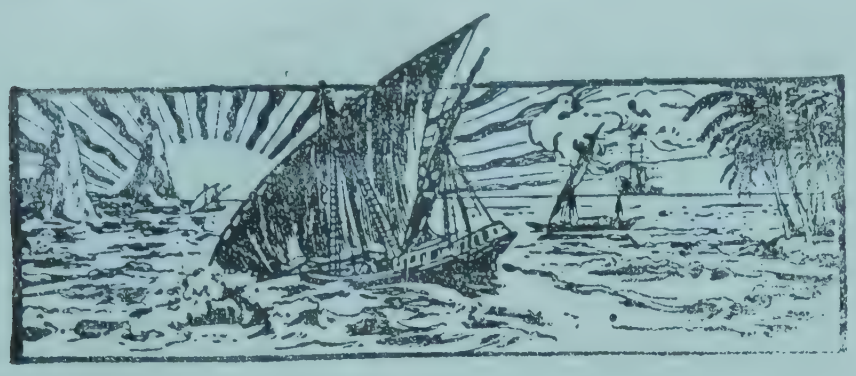
3 Buds should never be inserted in an inferior small stock. The nursery should be carefully inspected just before budding starts and all inferior small stocks removed.

4. When the budded plants have reached the age for transplantation into the orchard, they should be carefully inspected again, and all those on which the bud growth is small should be again eliminated.

Citrus orchards should last for many years. It is therefore poor policy to plant anything but the best trees. Only the best buds, the best stocks, and the best resulting plants should be used for permanent cultivation.

DEPARTMENT NEWS.

Sir Francis Watts, K.C.M.G., the Imperial Commissioner of Agriculture for the West Indies, left Barbados for Trinidad by R.M.S. 'Quillota' on July 15 on official business He returned to Barbados by R.M.S. 'Chaleur' on July 19.



GLEANINGS.

Dr. G. A. Fassio, a medical officer of health in Guayaquil, contributed a paper to the *Perfumery and Essential Oil Record*, June 1920, on the campaign against hookworm disease. He discusses the relative efficacy of thymol and chenopodium oil as remedies; this he thinks is practically equal, but he considers that thymol is easier to administer, and that the danger of poisoning is more obvious with chenopodium.

Estimates for next year's pine-apple crop in Cuba are put as high as 1,500,000 crates, as the growing of pine-apples in Cuba has been extensively devoloped, and, with proper encouragement from transportation companies, the growth of the industry will doubtless continue. The superiority of the Cuban grown pine-apple is evidenced by the great demand manifested for them in northern markets. (The *Cuba Review*, May 1920).

Facts About Sugar, June 19, 1920, states that one of the most important developments which has taken place in the sugar world recently has been the formation of a syndicate of mills embracing properties in Santo Domingo and Cuba, whose total output will be close upon 1,000,000 bags of sugar a season. Two of the mills acquired by the new syndicate in Santo Domingo have a combined output of some 50,000 tons, or from 325,000 to 350,000 bags.

That very large areas in the American South-western States will sooner or later be given over to the culture of rubber-producing plants, is the opinion of Dr. Herbert J. Webber, one of the leading plant breeders in the United States. He is confident that the Chrysothamnus could be made to yield 15 or 20 per cent. of rubber, after improvement through breeding and selection. This, of course, does not mean that Chrysothamnus is the best plant for rubber cultivation in the south-west, but that it is one of the sorts which should be given a trial. (The *India Rubber World*, July 1, 1920.)

Few people realize how vast is India's numerical wealth in live stock. The data are imperfect, but, so far as they go, they seem to show that India leads the world in number of live stock, with something like 318,000,000 head, including 177,000,000 cattle, 39,000,000 buffaloes, 45,000,000 sheep, 52,000,000 goats, and 5,000,000 mules, horses and donkeys. In 1916-17 hides and skins, raw and tanned, were exported from India to the value of £15,800,000. Before the war a considerable portion of this trade had been captured by Germany and Austria. (*The Field*, July 3, 1920.)

While early reports had it that a larger rice acreage for California was planned for 1920 than for any previous year, the long-continued drought and extreme scarcity of water, in spite of the partial relief from late rains, make it certain that much of the land prepared for rice must either be abandoned for the present season, or planted to some crop that requires much less water. Of the few crops which may prove successful under the conditions obtaining in the rice lands of the Sacramento Valley, the most promising are the various kinds of sorghum. (*Monthly Bulletin* of the Department of Agriculture, State of California, May-June, 1920)

The Hawaiian Board of Forestry is performing very extensive and useful work in the reafforestation of the islands In the Annual Report on Forestry, published in the *Hawaiian Forester and Agriculturist*, May 1920, it is stated that during the year operations on forest reserves in need of reafforestation have been extended. In spite of a comparatively dry year, a total of 32,648 trees of various species were planted out on government lands in the two islands of Oahu and Kauai. Reports received from tree planters through the territory show that, during the year a total of no less than 634 823 trees were planted on the four main islands of the group, including the two mentioned above.

The *West India Committee Circular*, June 10, 1920, says that it is difficult to imagine why the British Board of Trade persists in continuing to classify saccharin with sugar and molasses, whereas it is one of the many products obtained from coal tar, and ranks with veronal, aspirin, and the hundred and one medicinal products familiar to nerve drug *habitués*. While, in time of emergency, there may not be any particular harm from its occasional use, there is probably great danger, in view of the high price and the shortage of sugar, of the use of saccharin becoming a habit, as is the case with other drugs. Nothing could be more detrimental than this to the health of the nation.

The production of nitrate of soda has grown to such proportions that the industry is now of world-wide importance, and the consumption (3,000,000 tons in 1919) is steadily increasing year by year. When the nitrate industry first began in 1830, only 813 tons were exported to Europe. Many theories have been propounded as to the origin of the famous Chilean saltpetre beds. Whatever that may be, the Chilean nitrate industry supports to-day a population of some 250,000 souls. In the production of commercial nitrate of soda there are about 170 factories at work. (*Proceedings of the Agricultural Society of Trinidad and Tobago*, May 1920.)

In a note on some products of Colombia, the *Journal of the Royal Society of Arts*, June 4, 1920, mentions the nut of the 'corozo' palm, which is said to be the same as the 'cohune' of Central America. There is an unlimited supply of raw material. When pastures are cleared for cattle the corozo palms are left for the gathering of the seeds. Two harvests are obtained yearly after the palm has attained the age of four or five years. The nuts are very rich in food value, the oil having been used by the aborigines for centuries. The extraction runs to about 25 per cent. of pure oil per weight of raw nuts after drying. About 25lb. of the nuts, which grow in large bunches, can be expected from each palm annually.

COMMERCIAL USES OF MANJAK IN TRINIDAD.

An article in the *Journal of the Royal Society of Arts*, June 4, 1920, most of which is reproduced below, draws attention to manjak deposits and their value in Trinidad.

Manjak is said to be more abundant in Trinidad than in any other part of the world; in fact, with the exception of Utah, Cuba, and Barbados, there are understood to be no other important deposits known. In case of a large demand arising for manjak, Trinidad probably offers the best opportunity for its production and export as an article of commerce.

While Trinidad is rich in its resources of manjak, the mining of it is as yet only in an experimental stage, and such exports as have taken place have apparently been chiefly for the purpose of testing uses to which it may be put.

In Trinidad itself, writes the United States Consul there, manjak is very rapidly coming into increasing use. Its utilization in connexion with the oil industry is especially important, manjak being produced in close proximity to the oil wells of the island. It is boiled locally with oils at high temperatures, and made into compounds and paints for use in the oil fields for practically every purpose for which a preservative is required—for pipe-lines, boilers, chimneys, sprocket wheels, pinions, and other ironware, machinery, etc. Entire pipe-lines are painted with it, and apparently, wherever it is used, the metal which would otherwise quickly deteriorate in the hot and damp climate, has its life almost indefinitely prolonged. When applied in a liquid state, the manjak quickly and readily hardens into a tough, unbreakable, and rubber like coating. It has a low viscosity, is not affected by ordinary heat, is a most excellent insulating material, and is impervious to both water and air.

The most important use of manjak, and the one for which it has won a reputation for immense saving of money, is in connexion with rotary drilling for oil. A soft compound is used on the joints of the pipes between the casing threads, and drill stem threads, and this prevents eitherwater, sand, or grit getting into the threads, and so preserves them from being stripped or worn off. It not only acts with particular efficacy in keeping each pipes water-tight and air-tight, and free from corroding influences at the joints; but also, having qualities as a lubricant, it facilitates the work of jointing and separating the pipes. It has been found much superior for such purpose to white lead or any other substance previously used, and results in very great economy.

The Government of Trinidad is now making important use of manjak in painting the under parts of bridges, and in other cases where protection is required from water; and a Trinidad company has secured excellent results from the use of manjak paints and compounds on steel smoke stacks, trucks, fenders and buffers, galvanized iron cans which are submerged in brine, and iron and steel work in connexion with power house and car building. The company also uses it successfully as an insulating varnish on armatures and electrical connexion, and in gear cases of mechanically propelled vehicles. It has proved especially valuable in connexion with overhead canvas coverings for vehicles, as protection from the hot tropical sun and rain.

The manjak deposits of Trinidad are found within a distance of only about 3 miles from San Fernando, the second largest town of the island, and within about 10 miles of the famous asphalt lake at Brighton. Manjak is much like asphalt in its chemical composition; but while the melting point of asphalt is low (100° F.), a temperature of over 400° F. is required to melt manjak. It is almost a pure bitumen. It looks like coal, is odourless, and is very hard and brittle, having a pencillated structure easy to separate in its long grains. It is found in long seams between layers of clay.

Manjak was mined in a small way in Trinidad previous to the year 1900, until a serious accident occurred from explosion of gas, resulting in a large loss of life, and so discouraging the proprietors that mining operations were discontinued. In 1913, however, mining operations were resumed by a company, which, by making use of modern appliances—especially safety lamps—has averted any further accidents. There are now five shafts, one of which reaches a 37-foot seam at a 400-foot level. The area where the mining operations occur, comprise about 1,600 acres, one-half mile from the Gulf of Paria. The operations could be greatly extended should the business conditions warrant it.

It has not been found profitable to export manjak from Trinidad in its crude state, the price received of only about $35 per ton hardly covering the cost of mining—an expense which is increased by the necessity of thoroughly timbering every tunnel and opening because of the loose formation of clay. However, by compounding the manjak with mineral oil, the special preparations thus made have been found to command very good local prices, and to make the mining operations quite profitable so far as they go. There is still considerable experimentation with different mixtures and different kinds and weights of oil for specific purposes, and the manjak which has lately been exported to the United States has been sent there for the purpose of testing whether American oils would prove more economical and useful for mixing purposes than Trinidad oils. It is the intention shortly, adds the American Consul, to erect a plant, either in the United States or in Trinidad, for the manufacture of a variety of manjak paints and compounds for all the special purposes for which they may be required.

The poultry industry is the most important of the live stock industries in China. Nearly every family in the villages in all parts of China raises fowls. The estimated total value of poultry and eggs produced each year in China is about £84,000,000. These are not all consumed in the country. In 1917, for instance, shipments of eggs (fresh and preserved) from China totalled 57,987,000 lb., valued at £400,000, and of egg albumen and yolk, 54,002,000 lb., valued at £2,590,000. The fresh eggs are exported chiefly to Hong Kong and Japan, and the dried product to Great Britain, Spain, and the United States. (The *Journal of the Royal Society of Arts*, May 28, 1920.)

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. During the month of June plant distribution included: cacao, 80 ; coco nut, 36 ; orange and grape fruit, 12 ; grape, 1 ; ornamental, 659 ; economic, 18 ; yams, 115½ lb.; eddoes, 134 lb.; onion seed, 5 oz.; horse bean, 132 lb.; cowpeas 1 lb.; seed coco-nuts 2,567 imported from Dominica ; other seeds, 335 ; cuttings, 3 bundles ; cane plants, (B.H.10.12) 800, imported from Barbados ; and guinea corn, 8 pints. Mr. R. O. Williams, Superimtendent of Agriculture, states that owing to the lateness of the rains it was not possible to plant most of the ground provisions plot until June : planting has now been completed. Seeds of Jamaica tobacco, received through the Imperial Commissioner of Agriculture, have been sown and are germinating freely. The planting of ground provisions in the island is in full-swing, also that of canes, several requests being made to the Department for plants of the latter. Further requests have been received for Marie Galante cotton seed, and all demands have so far been met. In many localities cacao is backward, owing to the lateness of the season ; in the higher-altitude it is commencing to fruit. Limes are blossoming heavily in the lowlands, and fruiting freely in the highlands. The price of butcher's meat has been advanced from 9*d.* to. 1*s.* per lb. No serious attack of thrips has as yet been reported for the season, this being attributed to the fact that the last two months have, on the whole, been dry. The Superintendent of Agriculture visited two estates possessing from 3,500 to 4,000 trees of Para rubber, thirteen to fourteen years old, and gave instructions as to tapping methods, and the making of biscuit rubber. The owners of the estates are taking great interest in this work. The Inspector of Schools and the Superintendent of Agriculture have selected six schools for the purpose of establishing school gardens. The rainfall recorded during the month at Richmond Hill was 36·1 inches.

ST. VINCENT. During the month of June plant distribution comprised the following: 1,000 onion plants, 100 Pilocarpus, 70 Eucalyptus, 2 palms, 51 packets vegetable seeds, 524lb. cotton seed, 50lb. Bengal beans, 380 coco-nuts, 25 Para rubber plants, and 10 miscellaneous. Regarding staple crops, Mr. T. Jackson, the Curator, states that a considerable amount of cotton was planted during the month, and the seed, on the whole, has germinated well. Provisions are getting scarce and expensive. Reaping of the cane crop continues under good conditions. During the month 1,649 bags potatoes, 99½ bags yams, 128½ bags tannias, 179 bunches plantains and bananas, and about £52 worth of miscellaneous vegetables were exported from the island. A successful Minor Industry Exhibition was held under the patronage of His Honour the Administrator, and under the auspices of the Imperial Department of Agriculture, at which 150 exhibits were staged. A visit by the Imperial Commissioner, who addressed a public meeting held at the Court House, is noted. The rainfall for the month, recorded at the Experiment Station, was 5·44 inches, and at the Botanic Station, 5·95 inches.

ST. LUCIA. Mr. E. Buckmire, Acting Agricultural Superintendent, writes to say, in connexion with the sugar crop, that reaping and milling are very nearly completed throughout the island. The local market for syrup remains steady. The showers, which were well distributed throughout the month, enabled the young canes to make quite a good stand, and the supplying of vacancies was vigorously conducted. The lime crop is rather late, but promises to be good. Towards the close of the month a fair quantity of limes was brought in to the factory by small growers. The prolonged drought affected the crop somewhat, and the fruits are in consequence smaller. Scale insects (*Chionaspis citri*) multiplied with great rapidity under the favourable weather conditions, particularly in the less sheltered plantations on light soils. The reaping of cacao is now completed: there is general improvement in the condition of the plantations. Considerable activity is taking place in the syrup industry, and peasants are increasing their areas under canes, thus giving a set back to food crops. The Agricultural Superintendent left for England on vacation leave on June 30. The rainfall recorded at the Botanic Garden, Castries, during the month was 3·49 inches; at the Agricultural and Botanic Station, Choiseul, 2·66 inches. Plant distribution during the month was as follows: ornamental plants, 186; grafted mangoes, 2; ornamental cuttings, 12; vegetable seeds, 23 packets; flower seeds, 5 packets.

NEVIS. Owing to continued dry weather, the crops in the Experiment Station made very little progress during the month of June. Plant distribution included 200 cassava cuttings and 3lb. of rounceval peas. The cane crop, Mr. Howell states, has all been reaped, and the young crop is in very bad condition. All the fields have grown irregularly on account of the dry weather, and in some places preparation had to be abandoned. The outlook for the 1921 cane crop is therefore very poor. The cotton crop throughout the island is very backward. A fair amount of planting was done during the month, and the germination on the whole was good ; but very few fields have made a good stand owing to the light showers after planting. In one distric, the young plants were badly cut by the grasshoppert Very little ground provision is now available. The rainfall for the month was 2·22 inches ; for the year to date, 11·26 inches.

BRITISH VIRGIN ISLANDS. Mr. C. A. Gomez, Curator, states that efforts were made during the month of June to establish cotton plots at the Experiment Station, Tortola, and approximately 3 acres of land were planted under the crop. Germination was satisfactory, but some 50 per cent. of the plants succumbed to the scorching sun and drought experienced subsequent to the sowing of the seed. Very high prices are at present ruling for Tortola stock in St. Thomas. The demand is very great, and cattle raisers may be said to be benefiting in a manner similar to cotton and cane growers by the general increase in prices. Approxinmately 25 per cent. of the cotton fields planted early in June had to be replanted on account of adverse weather conditions. Cotton growers generally may be said to have had a difficult task in developing uniform stands in the cotton fields, and, unless July turns out showery, it is feared that, in spite of the great interest and activity at present displayed in cotton growing, the 1920-21 cotton crop will be in a precarious condition. The remainder of the last cotton crop has been shipped: the crop aggregated 34,382 lb. of lint. Weather conditions presented a gloomy aspect to agriculturists during June. The total rainfall was only 1·32 inches.

BARBUDA. Notes received from Mr. V. G. Pereira, Acting Assistant Manager of the Antigua Government Estate, Barbuda, state that during the month of June the remaining 25 acres of land in the 'Guava' enclosure were cleared and put in preparation, making a total area of 75 acres now ready for planting. Of this, 60 acres will be planted in cotton and maize, and the remaining 15 acres in Guinea corn, as soon as weather permits. The field at 'Low Pond,' preparation of which has also been completed, will be planted in sugar-cane and Sudan grass which should ensure a fair supply of fodder for the stock in the dry season next year. In this connexion it may be added that, approximately 200 acres of jungle have now been converted into good grazing ground. The weather continued very dry throughout the month, the rainfall recorded being only 92 parts. The total precipitation from January 1 to June 30 was 9·67inches.

AGRICULTURE IN BARBADOS.

The month of June closed with a few showers, and the rainfall for that month was decidedly better than that for the same period last year This year an average fall of $2\frac{3}{4}$ inches has been recorded for the month in both the black and red soils, and the average rainfall for the year to the end of June is, in the black soils $13\frac{1}{4}$ inches, in the red soils 17 inches, as compared with $9\frac{1}{2}$ inches and $11\frac{1}{2}$ inches respectively, in the same soils for the same period last year.

July opened with a few light showers and heavy mists which developed into a splendid rain of $1\frac{3}{4}$ inches on the night of the 3rd instant. On the 5th there was a general downpour throughout the island; nearly 3 inches were recorded at one estate in St. Joseph. There has been a fair amount of wash from these rains; the land is now heavily soaked, and many cane holes were full of water after the rain ceased.

Planting of various kinds can now be done, and planter and peasant are very busy supplying their fields and small plots of canes. Very satisfactory progress is being made with the tillage of the land for yams, eddoes, and corn, and several fields have already been planted

Many fields of young canes will require extensive 'stumping', as they contain hundreds of dead and weak holes; it will be some time before many fields in both the black and the red soils will be able to recover from the set-back they sustained during the adverse weather which prevailed.

The plant canes, however, are more uniform than at this time last year; but the ratoons, particularly the Ba 6032 are very irregular. Supplying of young canes is very expensive work, and the greatest care should be taken in the selection of healthy stools for such a purpose Stools which are sending forth young shoots are the best for the work.

There are to be seen many fields of corn growing. but the leaves are very worm eaten; the results from those will not be very favourable. This has been caused by having had to plant old grain, and because the soil was not yet fit for planting them. Cuttings or slips of sweet potatoes are very scarce, as there are very few fields of old potatoes in the island, and the vines for the most part have been hard and dry. The scarcity of potatoes will hardly be relieved before November. The price paid for them now is 6c. per lb.

The scarcity of fodder is still keenly felt, and the price asked for it is now 8*s*. per 100 lb. In some places it is unobtainable; trash and molasses sprinkled with oil meal are the only means of subsistence for animals in nearly every parish. It is hoped that the situation because of the rains we are now getting, will soon be relieved, as milk vendors find it exceedingly difficult to feed their cattle, owing to the high cost of fodder and foodstuffs. (The Barbados *Agricultural Reporter*, July 10, 1920)

AN ICELESS REFRIGERATOR.

The desirability of keeping food stuffs and liquids cool under tropical conditions needs no elaboration. In the *Agricultural News*, April 3, 1917, directions as to the construction of an iceless refrigerator, which would keep coco-nut butter from 6° to 10° below the ordinary shade temperature, will be found.

The subject, however, is of perennial interest, and the following directions for the construction of a similar refrigerator, which are reproduced from the *Scientific American* in the *Nassau Guardian*, May 15, 1920, seem worth while bringing to the notice of our readers, especially as the reason of the process is explained.

Where ice is not obtainable an iceless refrigerator, home-made, will be found useful to keep meat, fruit, and vegetables cool. It will extend the keeping period for milk and butter, and will serve also as a cooler for drinking water.

The dimensions are 42 × 16 × 14 inches for the wooden frame. Adjustable shelves can be made of solid wood, or strips or sheets of galvanized metal. Shelves made of wire poultry netting on light wooden frames are probably the most desirable. A cover of canton flannel, burlap, or duck is made to fit the frame This cover is buttoned around the top of the frame and down the sides on which the door is not hinged, using buggy hooks and eyes, or large-edged tacks and eyelets worked in the material. Four double strips at the lower end of the cover drop into basins of water, and act as wicks to draw up the water.

Operation of the refrigerator is as simple as its construction. The lowering of the temperature inside the refrigerator depends upon the evaporation of the water. To change water from a liquid, to a vapour or to bring about evaporation, requires heat. As the evaporation takes place, heat is taken from the inside of the refrigerator, thereby lowering the temperature of the inside and its contents The lower pans are kept filled with water. The watvr is drawn by capillary attraction through the wicks, and saturates the cover. Capillary action starts more readily if the cover is first dampened by dipping it into water, or throwing water upon it with the hand. The greater the rate of evaporation the lower the temperature which can be secured Under id al conditions the temperature has been known to be reduced to 50° Fahrenheit. Obviously, weather conditions have a lot to do with this refrigerator. A warm dry day, with a slight wind, if possible blowing on the cover, produces the best results in maintaining coolness of contents.

Older residents in the West Indies, before the days of the manufacture of ice, will remember how wines and beer were cooled by covering the bottles with some close netted material, and placing them standing in a pan of water, where the wind could freely blow on them.

MARKET REPORTS.

London.—The West India Committee Circular June 10.

Balata—Venezuelan Block, no quotations; West Indian Sheet, 4*s.* 3½*d.* c.i.f., spot, 4*s.* 6½*d.* to 4*s.* 7*d.*
Beeswax—No quotations.
Cacao—Trinidad, 135*s.* to 140*s.*; Grenada, 100*s.* to 116*s.*; St. Lucia, and Dominica, no quotations; Jamaica, 115*s.*
Copra—£53.
Honey—75*s.* to 105*s.*
Lime Juice—Raw, No quotaions Concentrated, no quotations.
Pimento—5½*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T. S. Garraway & Co., July 21.

Arrowroot—$8·00 per 100 lb. duty paid.
Cacao—Lottings at 22c.
Coco-nuts—$52·00 husked nuts.
Hay—Sales at $6·00.
Onions—Sales at $11·00.
Peas, Split—No quotations; Canada, $12·50 small, $15·00 large.
Potatoes—Market bare.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, June 22.

Bay Oil—30*s.* to 32*s.*
Lime Oil—7*s.* 6*d.* to 7*s.* 9*d.* for West Indian distilled, and for hand-pressed 27*s.* 6*d.* per lb.
Orange Oil—West Indian, 40*s.*

Trinidad.—Messrs Gordon, Grant & Co., July 7.

Cacao—Venezuelan, $24·00 Trinidad, $17·00.
Coco-nut Oil—$2·35 per gallon.
Coffee—Venezuelan, 24c. per lb.
Copra—11c. per lb.
Dhal—No quotations.
Onions—$4·00 to $5·00 per 100 lb.
Peas, Split—$12·00 per 100 lb.
Potatoes—English, $8·00 per 100 lb.
Rice—Yellow, $14·50 White, $15·00 per bag.
Sugar—No quototions.

New York.—Messrs. Huth, Gillespie & Co., Inc. June 18.

Cacao—Caracas, 19c. to 19½c.; Grenada, 18c. to 18½c.; Trinidad, 18c. to 18½c.; Jamaica, 13½c. to 14½c.
Coco-nuts—Jamaica selects, $60·00 per M; Trinidad $55·00 per M; culls, Jamaica, $40·00; Trinidad $38·00 per M.
Copra—9¼c. to 9½c.
Coffee—Jamaica, 17½c. to 23c. per lb.
Ginger—38c. to 40c. per lb.
Goat Skins—Jamaica. Antigua, and Barbados, $1·00. St. Thomas and St. Kitts 80c.
Grape Fruit—Jamaica, $3·00.
Limes—No market.
Mace—36c. to 38c.
Nutmegs—24½c. to 25c.
Oranges—No Market.
Pimento—8¾c. per lb.
Sugar—Centrifugals, 96°, 21c.; Muscovados, 89°, 19¾c.; c. & f., Molasses, 89°, 19¾c.

Special Selected Sea Island Cotton Seed

— FOR —

PLANTING PURPOSES.

We can supply you with the above, selected from Seed grown at the Government Industrial Schools, and the Lunatic Asylum Farm, under the supervision of the Agricultural Department. Lint from this Seed has been highly reported on by the Spinners in England.

WE SOLICIT YOUR ORDERS. ☚

The Barbados Co-operative Cotton Factory, Ltd.

WHITE PARK.
May 15, 1920.

AGENTS FOR PUBLICATIONS OF THE IMPERIAL DEPARTMENT.

London: Messrs. Dulau & Co., Ltd., 34-36, Margaret Street, Cavendish Square, W.
West India Committee, 15, Seething Lane.
Barbados: Advocate Co., Ltd., Broad Street, Bridgetown.
Jamaica: The Educational Supply Company, 16, King Street, Kingston.
British Guiana: The Argosy Co., Ltd., Georgetown.
Trinidad: Messrs. Muir-Marshall & Co., Port-of-Spain.
Tobago: Mr. C. L. Plagemann, Scarborough.
Bahamas: Mr. N. D. Sands, Board of Agriculture, Nassau.
Grenada: Messrs. Thos. Lawlor & Co., St. George
St. Vincent: Mr. Floris Simmons, Experiment Station.
St. Lucia: Mr. R. W. Niles, Botanic Station.
Dominica: Mr. W. G. Hutton, Botanic Garden.
Montserrat: Mr. W. Robson, Botanic Station
Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre.
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 801, Yonge Street, Toronto

AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

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The Tropical College of Agriculture.

THE Secretary of State for the Colonies has recently communicated by telegram to the Governors of Trinidad aud Barbados, nd to the Imperial Commissioner of Agriculture for ne West Indies, that His Majesty's Government has ow approved of locating the Tropical College of griculture in Trinidad. It may be considered there- re, that the foundation of such a college is no longer scheme, but an absolute reality. The choice of rinidad as the site of the College implies a general pproval on the part of His Majesty's Government f the report of the Committee appointed to deal with ne subject, as will be seen by reference to that eport, which was dealt with in the issues of this Journal, March 6, and 20, and April 3, of the present year. The report itself will also be found reproduced in full in the *West Indian Bulletin*, Vol. XVIII, page 1.

It may be remembered that the Committee after careful discussion came to the conclusion that Trinidad was the most suitable locality for a tropical agricultural college, which should be Imperial in its outlook. For several reasons Trinidad affords advantages not possessed by others of the West Indian colonies for studying the various kinds of tropical crops. In that colony almost all the forms of staple tropical crops are being cultivated under thoroughly tropical conditions, Labour conditions also afford opportunity for observation and study in Trinidad, owing to the diversity of the people in regard to race. Another point which recommends Trinidad for the purpose for which it has been chosen is its proximity to the South American Continent, thus affording opportunities for study of the tropics and tropical agriculture under continental conditions, and not only with reference to small insular areas. Last, but not least, communication with Trinidad from British Guiana in the South to the British Virgin Islands in the North, has been in the past, and it is hoped will continue to be in the future, comparatively frequent and easy.

It is not necessary now to detail the history of the movement in favour of establishing a tropical agricultural college within the Empire; that subject was dealt with in the first of the articles in the *Agricultural News* referred to above. It is sufficient to say that the establishment of such a college has been an object long in contemplation by the Imperial Department of Agriculture for the West Indies, and by those who have really at heart the development

of the resources of all parts of the Empire on sound lines.

Now that the actual accomplishment of this long desired object is being fulfilled, it is well to consider what the Tropical College of Agriculture will aim to be. It must be much more than a practical school for instilling the rudiments of scientific agriculture, though of course, a large and important part of the work of the College will be to train different types of responsible agricultural workers so as to fit them for various positions, such as managers of plantations, officers of agricultural departments, sugar chemists, etc.

In this connexion the importance of the sugar school as a working department of the College will be recognized; in it men will be trained in order to fit them for the various positions of responsibility belonging to the sugar industry. As the sugar school will be an integral part of the College, it is intended that the men who specialize on these lines will be enabled to take a broad view of their work. Giving to students a broad and sane outlook is in fact a great point to be aimed at by the institution of the College.

Besides the special training which will be possible in the sugar school, it is certain that similarly practical training of an analogous kind will be given in connexion with other staple industries, such as cacao, cotton, coco-nuts, and limes.

In addition to practical instruction based on broad agricultural science, the aim of the College will be to attract students for post-graduate courses on various lines. Specialists are much needed for the investigation of many problems connected with tropical agriculture; at present there are very few opportunities for them to gain the required instruction under tropical conditions. One great aim of the College therefore will be that students, who desire to specialize in any line connected with tropical crops, their pests and diseases, or their products, may be enabled to carry out research amidst tropical aspects, and with tropical material at hand, so that they may go forth more fully trained and better equipped than has been the case with many of their predecessors.

From the above considerations the necessity of supplying the College with a competent staff of teachers will be evident. The encouragement of a body of research workers may be said to be the basis of the formulation of knowledge and of the imparting of its results. In order to obtain the right kind of knowledge, and to ensure the right atmosphere, it is essential that those who teach such subjects as are here contemplated should themselves be investigators; they must not only keep abreast of growing knowledge, but, to be fully efficient, must be adding to that knowledge: hence research must be a dominant note in the life of the institution.

One aspect connected with the creation of such an institution, which deserves passing notice, is the general influence that a body of live, active, thinking men may, and doubtless will, have on the community as a whole. By their daily intercourse with others they cannot fail to diffuse information, to stimulate mental activity, and to be a useful factor in forming that body of public opinion which does much to mould the development and progress of a community.

It is necsssary that sound ideas should prevail with regard to the scope and aim of the Tropical Agricultural College. There must be no impatience with regard to the immediate obtaining of results; it will take time for the College to train and turn out a body of graduates, and it will take time for its investigations and researches to mature: so reasonable patience must be exercised, undue pressure in these directions would be detrimental, and would lead to indifferent work. A broad outlook too is essential; sound training is what must be demanded, for sound training alone is likely to yield results which, in the long run, will ensure increased efficiency and increased production, whereby the work may be justified when regarded from the point of view of monetary value.

The College will necessarily benefit tropical agriculture, not only by turning out a certain number of men who will understand how to fill certain positions adequately in their future life, and so make decent livings, but it will benefit the tropics by turning out men who, it is hoped, will be able to think for themselves, and be endowed with a rational and liberal way of looking at the problems of their life tasks. To be all that it is hoped and intended that it shall be, the Tropical Agricultural College cannot, like Pallas Athens, springing full armed from the head of Zeus, issue complete and full-grown from the brain of any one man or body of men. On the contrary, this agricultural college must grow from possibly small beginnings into a stately tree of

nowledge, the fruit of which will be scattered far nd wide for the benefit of the Empire.

To ensure such a result the cordial support of he various colonies who are assisting in its founda- ion is needed; and this, not only pecuniarily, but vith understanding based on a sound conception f the aims of the College. The return to be expect- d from the establishment and work of the College vill be a continually increasing body of past students, vho, by the knowledge acquired and the training ained in the institution, must necessarily be an ncreasiug source of power and benefit to tropical griculture, and the development of the resources of he Empire.

THE AGRICULTURAL OUTLOOK IN ST. VINCENT.

COTTON.

In the previous issue of this Journal attention was lrawn to an address delivered by Sir Francis Watts in St. Vincent, on the agricultural outlook of the colony, and the portion of the address referring to the sugar-cane industry vas largely reproduced.

In the following paragraphs, much of what Sir Francis Watts said with regard to the cotton industry is quoted as of general interest to cotton planters in the West Indies. Sir Francis referred to the fact that cotton was now the dominating industry of the colony and was likely to remain so, for the cultivation of this crop is rapidly diminishing in those American States where it was formerly grown, its dis- continuance being mainly due to the invasion of those areas by the Mexican boll weevil, which has proved uncontrollable n connexion with Sea Island cotton, though it may be combated in connexion with short staple cotton, when arly maturing varieties can be grown. This serves as warning to West Indian cotton growers, for it plainly shows how a single pest may ruin an industry, and how, in some cases, all that money and effort can do is incapable of finding remedy. Cotton planters had been more fortunate in St Vincent, for, although the cotton crop had been faced with an alarming array of pests and diseases, some of which were entirely unknown before cotton growing became an impotant industry there, still it had been found possible to devise means of control or remedies for them.

The success of most of the methods of control depends on the joint action of the cotton growers, so that cotton grow- ing on a community basis is now recognized to be the only way in which cotton growing is possible, particularly when the growing of Sea Island cotton is concerned. To make this community action possible, it had been necessary to invoke the aid of Government, so that there were laws on the Statute Book making certain lines of action compulsory, This aspect of the case was worth a moment's considera- tion. The Government had not taken these steps from a desire to interfere in the industry, but it had taken them at the instance of the cotton growers themselves, so as to enable the growers to ensure that community action which is essential, This being so, it was well to remember that the successful working of the measures requires the constant co-operation of the cotton growers themselves. It was most undesirable that the feeling should gain ground that these measures were principally matters of Government concern, and that the Government was mainly responsible for the succeas or failure of the measures. The measures were mainly the concern of the cotton growers who had invoked the assistance of the Government to ensure that they were carried out by everybody: but the individual cotton growers must faithfully do their part, or the industry might be exposed to danger.

The success of the efforts to control internal boll disease, cotton stainers, and other pests and diseases had been remarkable. To these efforts and their success the colony entirely owed its cotton industry which to-day had a value to the colony of fully £175,000, or possibly more, though it was to be admitted that values were at present inflated: still the industry was expanding, and might attain those values even when the inflation ceased. Due recognition must be given to the work done by Mr. Sands and his assistants in this campaign against the cotton stainer, and in allied work; they undertook a task which might have proved impossible, and carried it through by sheer determina- tion and devotion to duty. It now remained to be assured that the work was efficiently carried on, and cotton growers as well as the Agricultural Department and the Government should see that this was done. It might be necessary to strengthen the hands of the Agricultural Department; it would be nccessary carefully to organize the campaign, but it would be equally necessary for individual planters to do their share.

It was to be remembered that the work was not com- plete with the destruction of the food plants of the stainer, for some few insects were bound to escape, or to survive from one season to the next, so it was imperative to keep a careful lookout for their occurrence and to destroy them rigorously. Now this was the work of the individual, and not of the Government.

It should be well remembered that under the Cotton Stainer Ordinance it was an offence to harbour cotton stainers, so that if anyone had cotton stainers on his cotton fields or in or around his buildings, he was liable to prosecution and penalty for the offence. The necessary steps to safeguard the position had been taken by the Government; it was for the cotton growers themselves to see that they played their part in fighting a common enemy, which it was feared at one time might entirely destroy the cotton industry of the island, but which had been shown to be controllable, still, if neglected, yet might lead to its ruin. These were not unnecessary alarmist views, put forward to frighten cotton growers unduly: the effect of the boll weevil in America was sufficient evidence as to what an uncontrolled pest might do to the cotton industry.

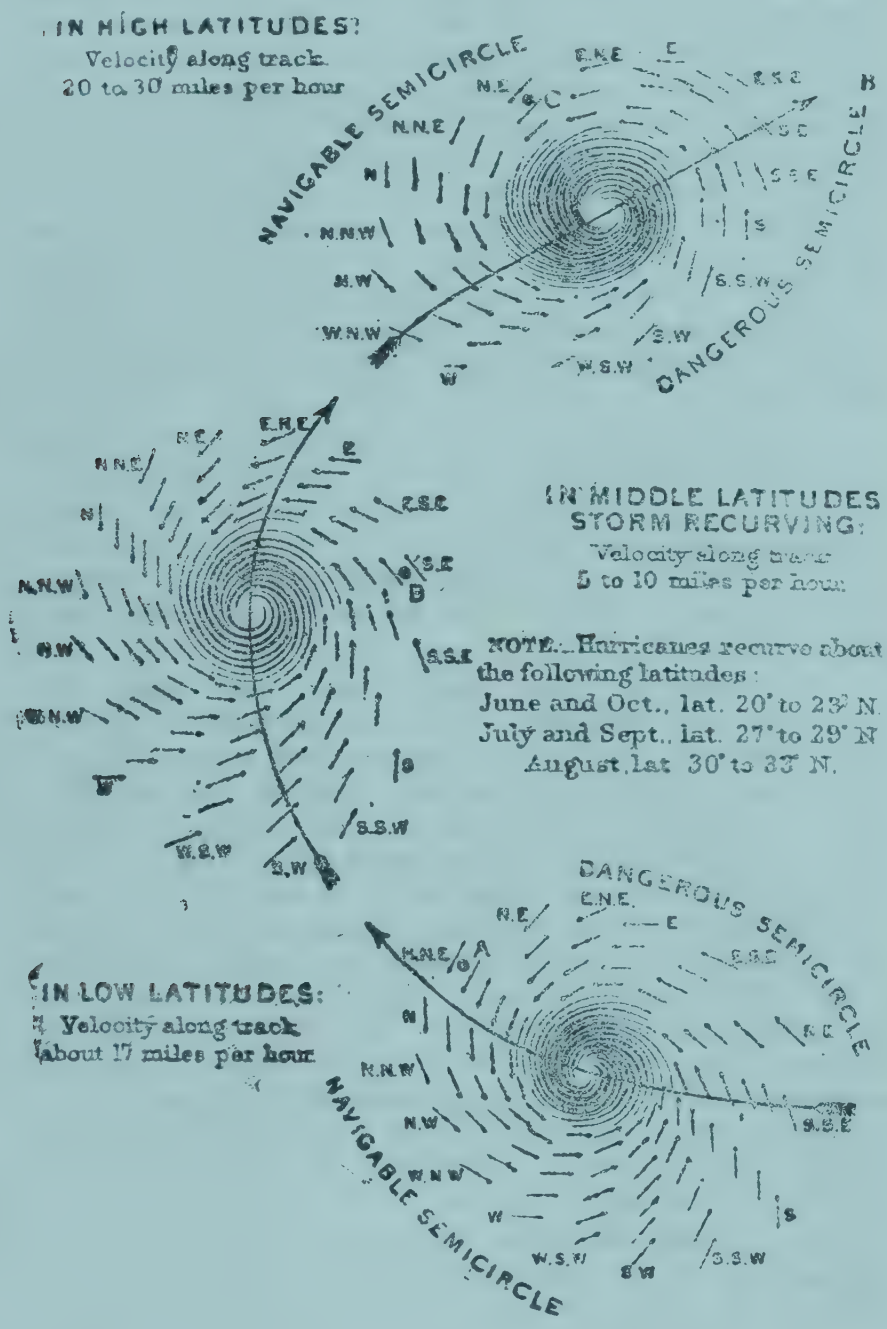
Sir Francis concluded this portion of his address by emphasizing the necessity for the greatest care in maintain- ing the quality of the cotton by the use of the right type of seed. This matter had been the subject of much attention on the part of the Agricultural Department in the past, and care had been taken to ensure a supply of good quality seed for general planting. The work that had been done by Messrs. Sands and Harland in St. Vincent, together with that of workers in other islands, was now telling: the quality of the cotton produced had been inproved, and the yields increased, and it was hoped that the progress in this direction would be materially extended to the benefit of growers and spinners alike.

HURRICANE WARNINGS.

The beginning of the hurricane season makes it desirable to republish the following information concerning their nature, and the signs which indicate the approach of these storms in the West Indies.

It is urged that instruction in connexion with this subject should be given in all secondary schools in the Windward and Leeward Islands, and possibly in the primary schools as well. One or two lessons given in each year at the beginning of, or preferably immediately before the hurricane season should prove of real service.

It is first desirable to point out the nature of a hurricane and its path of transition. With this object the diagrams below have been reproduced, having first appeared in this Journal in connexion with an editorial on hurricanes (see *Agricultural News*, Vol. VIII, p. 209).


IN HIGH LATITUDES:
Velocity along track
20 to 30 miles per hour
NAVIGABLE SEMICIRCLE
DANGEROUS SEMICIRCLE
IN MIDDLE LATITUDES
STORM RECURVING:
Velocity along track
5 to 10 miles per hour
NOTE.—Hurricanes recurve about the following latitudes:
June and Oct., lat. 20° to 23° N.
July and Sept., lat. 27° to 29° N.
August, lat. 30° to 33° N.
IN LOW LATITUDES:
Velocity along track
about 17 miles per hour
DANGEROUS SEMICIRCLE
NAVIGABLE SEMICIRCLE

The lowest figure represents the storm during its passage through the West Indian islands, before it takes a sweep round to the north or west of Cuba, into the North Atlantic (top figure).

The motion of rotation, and the motion of translation may be well understood by spinning a top and giving it a counter-clock rotation It will be seen that while the rotation may be very rapid round the centre, the top itself may remain in one spot. This rotation corresponds with the violent wind of the hurricane. By noting the direction in which any part of the edge of the spinning top is moving in relation to the centre, it will be obvious that the position of the centre is at right angles to this line of movement. Consequently in a hurricane, if the observer stands facing the wind, the centre of the storm is on his right hand. He can trace the movement of the centre by noting the change in the direction from which the wind blows.

The reader will find it instructive to take a number of points on the lowest section of the diagram which corresponds with West Indian conditions, and note (a) the direction of this wind (the arrows fly with the wind), and (b) the relative position of the centre.

Reverting to the spinning top, while it may remain spinning on one spot, it may, on the other hand, move from this; there will then be two motions: a spin and a progressive motion; this latter is represented in the hurricane by the movement of the revolving storm from one place to another. Usually West Indian hurricanes approach the islands from the Atlantic, that is, from East or ESE, and travel towards Cuba and the American coast, where the path curves northward and finally eastward, so that the storms pass out into the North Atlantic.

This progressive motion across the West Indian islands is comparatively slow, ranging from about 7 to 14 miles an hour.

An observer, therfore, knowing the general trend of the hurricane's path, may, by observing the direction of the wind and its changes, form a very good idea of his position as regards the centre, and whether the centre is coming directly towards him or is passing on the north or on the south side of him

If the direction of this wind remains fairly constant in a direction NNE, or N or N NW, the probability is that the centre is directly aproaching. Conversely, when the wind's direction remains SE, SSE, and S., the centre is moving directly away.

Where the motion of the wind changes from NE to ENE, E and ESE, the centre is passing on the south side of the observer.

When the direction changes from NW to WNW, W and WSW, the centre is passing to the north of the observer

These rules apply in the West Indies only: they should be checked by making trial observations on the lowest figure in the diagram until the matter is clearly understood. From these an observer can anticipate fairly exactly what may be expected to happen, and—a matter of great importance — he is able to recognize when the centre has passed, and the storm may be expected to begin to abate.

The violence of the wind increases as one approaches the centre; at the centre itself there is an area of calm. When this centre passes over any particular place the direction of the wind suddenly changes, and the wind, after its passing, begins to blow violently from exactly the opposite direction from that from which it blew before: this is a feature of considerable importance in West Indian hurricanes. The barometer falls rapidly as one gets nearer and nearer the centre, so that the barometer affords a means of marking the approach of the centre, and the probable distance that it is away, while the changes in the directions of the wind afford clear indications of the line along which the centre is travelling.

In judging the direction of the wind it is best to note the direction in which the lower clouds are moving: this is better than observing weathercocks or flags.

It is worth noting that in the West Indies—the rule does not apply elsewhere—in describing the direction

the wind, when one employs the term south, the centre has passed and conditions may be expected to improve. This may be confirmed by noting the position of the centre in relation to such winds as SSW, or SE, or any in which the term south occurs.

On the other hand, the dangerous position is indicated by those winds which involve the use of the term north, as may be seen by noting what is implied by such winds as NNE, or N, or NE.

The first indication of an approaching storm is frequently a heavy swell, breaking in heavy surf along the shore; these waves come from the direction of the centre of the approaching storm. They may be noticed many hours, sometimes a day or two, before the storm passes.

The next indication is usually some disturbance and unusual movement amongst the higher clouds, coupled with unusual light, often a coppery glare, at sunrise or sunset, particularly the latter; the wind is then unusually irregular and puffy, and the atmosphere moist and oppressive. The next indication is a fall in the barometer, and then the observer may feel certain that a cyclone is in existence.

It is worth noting that cyclones may, and do exist, in which the wind is rotating with only moderate velocity; they present all the characters here referred to, save that not having violent winds they do not cause much damage, it is only when the wind blows violently that a cyclone becomes a hurricane.

These facts are readily grasped and appreciated; a knowledge of them is of great service to West Indians, enabling them to take such precautions as are possible to protect themselves and their property from approaching storms, and relieving their minds of great anxiety when they are able to recognize that a threatened storm has passed.

THE JAMAICA IMPERIAL ASSOCIATION.

The work of this Association in furtherance of the agricultural and commercial prosperity of Jamaica has been referred to more than once in previous issues of the *Agricultural News*. Composed, as the Council of the Association is, of leading planters and merchants in the colony, its resolutions are worthy of attention. This seems to be especially the case with regard to a resolution of respectful protest against the alleged intention of the Government to impose an additional Excise Duty on sugar and an Export Tax on bananas. This resolution was passed at a meeting held on June 15, 1920.

The Government's attention was drawn to the fact that 8 per cent. of the sugar manufactured in the island has been voluntarily surrendered by the sugar mannfacturers for local consumption, at one-third of the present price of sugar in the open market, and that this means a surrendering of sugar profits on the part of the cane planters and manufacturers amounting, at present prices, to fully £200,000.

The resolution went on to point out that an excise duty on sugar, first levied in 1916 as a temporary revenue measure, had been retained ever since, and had been a source of an appreciable amouut of revenue annually. It also pointed out that in view of the fact that Imperial Preference on colonially produced sugar has been granted by the Mother Country for the purpose of increasing the production of sugar, a heavy excise duty on sugar would tend to frustrate the benefits of such preference, and would retard rather than encourage the development of the industry.

With regard to the export tax on bananas, it was shown that the Jamaica banana industry had of late years suffered many misfortunes, which had caused a considerable loss of capital to large and small growers alike. In 1914 there were exported from Jamaica 16,201,772 stems of bananas. Then followed the hurricanes of the three succeeding years, to which must be attributed the enormous decrease in this export, which was only 2,394,514 bunches in 1917. Since then there has been some recovery in the industry, the exports for 1919 having reached 9,675,557 bunches.

With regard to both the sugar and the banana industries, it was argued that the system of singling out one or two industries for special heavy taxation was calculated to give rise to uneasiness as to the attitude of the Government towards such industries, and to retard further investments of capital in them. The recently passed super-tax on land already imposed a heavy direct tax on a very limited number of persons, and in connexion with this the present proposal, if passed, would lead large promoters of industries to believe that they are to be singled out for special fiscal impositions.

It was stated that the imposition of an Income Tax, by which means the earnings of all individuals and companies would pay their fair share to the revenue, the larger incomes paying a progressively higher rate than the smaller, was regarded throughout Jamaica as a good measure of finance, intended to take the place of taxes restricted in their application to special classes of the community.

Considering the yield of Customs duties ever since the beginning of this year, the Council of the Jamaica Imperial Association did not believe that there was any justification for supposing that the Government would be faced with any deficit at the end of the current financial year, owing to expenditure actually determined upon or hitherto announced by the Government.

In conclusion His Excellency the Governor was respectfully asked to abandon his alleged intention of imposing an additional excise duty on sugar and an export tax on bananas.

As has been noted in a previous number of the *Agricultural News*, the voluntary action of the sugar planters and manufacturers in Jamaica in assuring to the population of that island an adequate supply of sugar at a reasonable cost, involving thereby considerable self-sacrifice, was a wise as well as a kindly action, and must have tended to keep the labouring population especially in a patient, if not exactly contented state of mind, in spite of the high prices of other commodities.

DEPARTMENT NEWS.

Dr. S. C. Harland, Assistant for Cotton Research on the Staff of the Imperial Department of Agriculture, has resigned his post. He has been appointed by the British Cotton Industrial Research Association as Acting Head of the Botanical Department of the Association, whose headquarters are in Manchester.

Mr. T. G. Mason, M.A., B.Sc., Agr. B., Botanist on the Staff of the Imperial Department of Agriculture, arrived in Barbados on August 5, to take up the duties of his office.

Mr. K. W. Earle has been attached by the Secretary of State for the Colonies as Geologist to the Staff of the Imperial Department of Agriculture, and will shortly be leaving England for the West Indies.

PROPAGATION OF SOME TROPICAL FRUITS.

CULTIVATION OF THE PAPAW.

The following article, with the accompanying illustrations, has been contributed by Mr. R. S. Cunliffe, B.Sc., in continuation of other articles on the propagation some tropical fruit:—

The papaya, generally supposed to be a native of the American tropics, is now a common form among the vegetation of most, if not all, tropical lands. Botanically the plant belongs to the tribe Papayaceae and the genus Carica, the latter of which includes several species all containing an acrid, milky juice, but differing in characters of foliage, fruit, etc., the only species of general commercial importance at present being *Carica papaya*, commonly known as the papaw. Even within the limits of this species, the characters of the plant vary considerably. The plant varies in height form 8 to 10 feet and from 4 to 6 inches in diameter of trunk, to over 20 feet in height with a trunk diameter of 2 feet. The leaves and petioles differ materially in form and colour through several shades of green, with or without purple or voilet-red markings. The fruits are mostly green when immature, but differ widely in colour when ripe, from green, yellowish-green, yellow, with or without red markings, to purple. The form of the fruit is equally variable, and may be oval or roundish, pear-shaped or oblong, and the size varies from a few ounces in weight to 25lb. The flesh is generally a shade of yellow, but in some strains it is reddish. A cross section of the fruit may show a thick meat with a small seed cavity, or a large interior cavity with a comparatively small amount of flesh. The seeds may be many, few, or entirely absent. The flavour of the fruit of *Carica papaya* is also a variable factor, from insipid, through varying degrees of quality and intensity, to objectionably strong and camphoraceous. But perhaps it is in the sexual characters of this plant where the greatest interest, as well as the greatest problems lie for the tropical horticulturist and plant breeder, On this basis alone no less than twelve or thirteen forms of the plant have been recognized, some at least of which are capible under certain conditions of changing over to other forms even of directly opposite sex. This habit is well exemplified in the male trees, which, if topped or otherwise injured, may sometimes be induced to assume the aspect and bear the flowers and fruits of the female. As is known to most people in the West Indies who possess even a casual acquaintance with this plant, it is approximately true to say that male and female flowers are borne on different plants, and that the pollen of the male flowers must be carried to the flowers borne by the female tree by insects or other means before such plants bear fruit Those who have had some experience in growing papaws will agree that it is not often that one has to worry about the possible deficiency of male blossoms in his fields. Unfortunately there is frequently much more reason to be concerned over the superabundance of male trees, some plantings, even from carefully selected seed, resulting in nearly all male trees. Although, however, it may be approximately true to divide papaws into these two main classes, it is not, fortunately for the plant breeder, an invariable rule. In fact there are few races of plants that show the peculiar sex variations and gradations found in this species.

Fig. 9 Male Papaw Tree With Developed Fruit.

Some of the more important of these variations are as follows :—

(1) The female papaw is one of the commonest and best known of these types. The distinguishing characteristic of this is that the tree bears only female or pistillate flowers, which, in order to develop fruit, must receive pollen from the flowers of the male tree. The fruits vary in form and other characteristics, but are usually round ish or oval.

(2) The opposite of the above is of course the male or staminate tree, easily known by its long branching panicles of flowers, which, in the typical male tree, are invariably staminate or pollen-producing.

Therefore such plants bear no fruit, and are only of use to produce pollen necessary to fertilize the pistillate flowers on other trees. There are, however, several forms of pollen bearing trees, one of which differs from the ordinary and typical male tree in that some of the flowers are hermaphrodite, that is they possess both male and female organs. In such cases the so-called male tree bears fruit, as shown in the accompanying illustration, such fruit being developed from the hermaphrodite flowers The fruits areusually small, and vary in shape, being oval, oblong, or pear-shaped, and may be few or many, according to the number of fertile flowers Frequently such fruit do not reach maturity, as they become too heavy to be supported by the long slender peduncles, and so fall to the ground. The phenomenon is interesting, as showing the possible variations within the species, but is valueless from a commercial point of biew. Frequently the ordinary male tree can be made to produce fertile fruit-bearing flowers by wounding the plant.

(3) Besides the forms above noted we have a form of tree which resembles the ordinary female plant in general appearance, but differs from it in bearing two types of flowers, both borne on short peduncles close to the main stem like the ordinary pistillate blossoms. One form of these consists of male flowers, bearing only pollen, which, however, so far as is known, appear to be sterile. The other form is a hermaphrodite flower (the large central flower in the illustration), resembling the ordinary female bloom in outward form, but somewhat more elongated, and self-fertile, and therefore independent of pollen from the male tree for fruit production. This type of tree is probably the most important, and is the most desirable to propagate from the point of view of the practical horticulturist, as the unproductive male tree is thus eliminated, or at least reduced to a very small number, thereby increasing the production and consequently earning power of a given area of land planted to this crop. Other forms of this tree are known to xeist, differing from one another and from those above mentioned chiefly in character of flowers and fruit, but as such are only variations in degree from a common type, they are not mentioned here. Owing to the peculiar variations of this plant, especially regards its flowering and fruiting characters, its successful opagation presents some interesting problems. As long as e trees are grown only as isolated specimens for home use, e fruiting characters of the plant are perhaps not a matter of eat importance, though even here the failure of the product a few trees to reach the standard of excellence desired by eir owner is apt to result in more or less vexatious disappointment; but when an attempt is made to raise the crop on a commercial scale, the failure of a certain number of trees to produce the quantity or quality desired presents quite a serious financial aspect. Therefore it is necessary, at least when growing the crop for market, that some other method of propagation be adopted than that of haphazard sowing of the seed. Papaws are grown in tropical countries for two main objects: for the fruit, and for the production of papain. When the crop is grown for the first of these objects there are perhaps three principal ends to be desired in its successful cultivation. First, the reduction of the percentage of unproductive (male) trees to a minimum, or the elimination of them entirely. Secondly, the increase of the productive capacity of bearing trees. Thirdly, the improvement of the quality of the fruit along such lines as size, thickness of flesh, flavour and aroma, keeping and carrying quality, and general adaptability for market requirements.

With the object of best attaining such ends several methods of propagating this crop have been tried at different times and in different places. Several of these have been successful in the main, or are promising, while others have failed. The oldest and commonest method of propagating papaws is from seed, and when carefully carried out, seems to offer the greatest promise of success, but if due care is lacking, the result is apt to be disappointing.

It has been proved that, by repeated selection of seed from plants bearing a large proportion of hermaphrodite flowers, the percentage of unproductive trees can be reduced to a minimum, but the selection must be rigidly kept up, as there is always the tendency for the type to break up, especially if the plants are subjected to sudden changes of environment, such as removal of seed from one locality to another.

[*to be continued*]

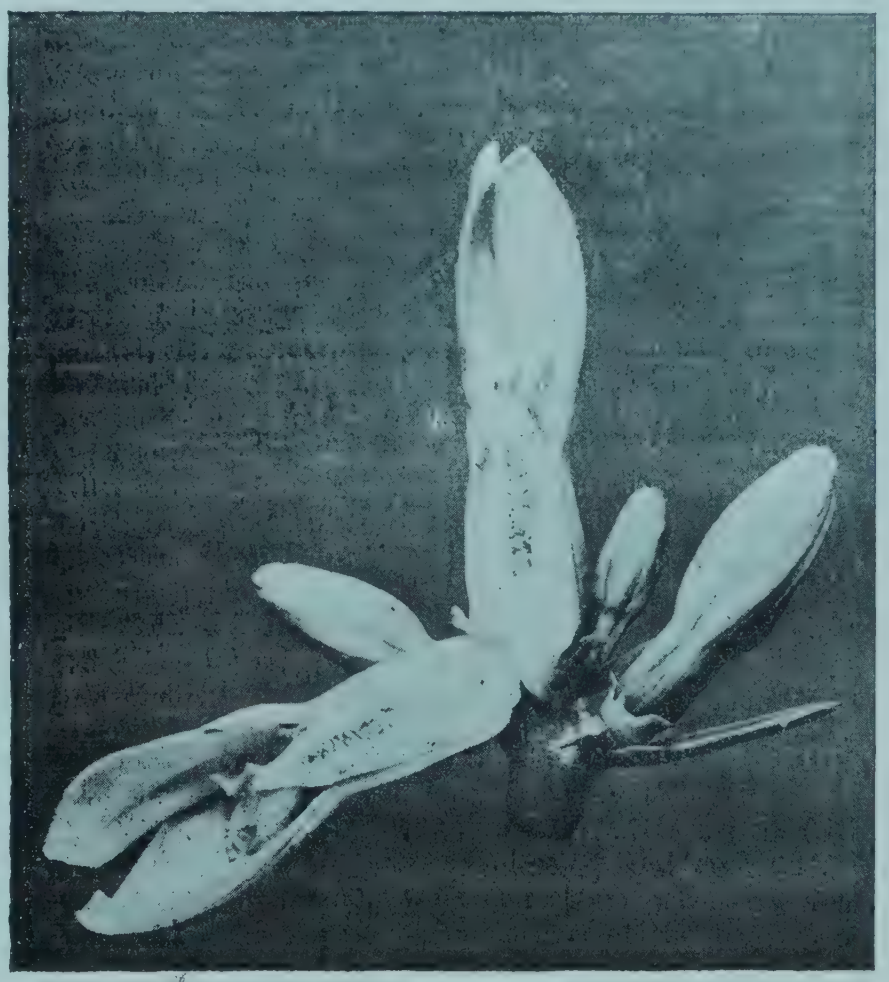


FIG. 10. HERMAPHRODITE FLOWERS OF PAPAW.

In Support of the Tropical Agricultural College.

The Colonial Secretary of Grenada moved a resolution at a recent meeting of the Legislative Council of that island, respecting the establishment of an Agricultural College in the West Indies, which was passed, to the effect that the Council gave its hearty support to the scheme set forth in the report of the Committee appointed by the Secretary of State, and that, on the condition that the College is established in Trinidad, the Council will be prepared to vote a sum annually for the support of the College to an amount not exceeding one-half of 1 per cent. of the colony's revenue.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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NOTES AND COMMENTS.

Contents of present issue.

The editorial draws attention to the scope and aim of the future Tropical Agricultural College to be established in Trinidad.

An article on the life history and methods of control of the green plant bug will be found under Insect Notes on page 250.

On page 244 there is reproduced from older issues of the *Agricultural News* information with regard to hurricanes, which is likely to be of value at this time of the year.

The first part of an illustrated article on the cultivation of the papaw will be found on page 246.

The point of view taken by cocoa manufacturers with regard to the raw cacao beans they purchase is presented in an interesting article on page 254.

Medal Awarded to Sir Francis Watts.

The Council of the Royal Society of Arts has awarded the Society's medal to Sir Francis Watts, the Imperial Commissioner of Agriculture for the West Indies, for his paper on 'Tropical Departments of Agriculture, with special reference to the West Indies,' which was read before the Society in the absence of Sir Francis Watts by Capt. A. W Hill, Assistant Director, Royal Botanic Gardens, Kew.

It is intended to reproduce the paper in full in the next issue of the *West Indian Bulletin*.

It may be mentioned that a similar medal has been awarded to Mr. Albert Howard, C.I.E., M.A., the well-known plant breeder attached to the Indian Agricultural Department, for a paper read before the Society on 'The Improvment of Crop Production in India.'

Government Geologist for the Windward and Leeward Islands

The Secretary of State for the Colonies has appointed Mr. K. W. Earle as Government Geologist for the Windward and Leeward Islands Mr. Earle's duties will be chiefly to make examination of the mineral resources of those colonies.

In the Secretary of State's despatch to the Imperial Commissioner of Agriculture for the West Indies, informing him of this appointment, it is stated that Mr. Earle, during the period of his employment will be attached, for the purpose of correspondence and supervision, to the Staff of the Imperial Department.

New Map of St. Kitts-Nevis.

Two new maps, prepared by the Geographical Section of the War Office for the Government of St. Kitts-Nevis, have just been issued. and can be obtained either from the Crown Agents for the Colonies or from the West India Committee. Both maps are wonderfully clear and up to date. The one of St. Kitts alone, which is the result of surveys by His Honour Major J. A. Burdon. C.M.G., F.R.G.S., the present Administrator of the Preisdency, is 23 inches by 18 inches, and is on a scale of 1 inch to a mile. There is an inset of a plan of Basseterre on the scale of 4 inches to the mile.

The other map is of St. Kitts and Nevis, on a scale of 1 inch to 2 miles, and is 19 inches by 14 inches. This has also been prepared by Major Burdon, based, as to St. Kitts, on McMahon's map of 1828. The mountain features around Basseterre are taken from Alexander's survey of 1880, while the remaining mountain features are taken from the Admiralty Chart of 1848. The map of Nevis is based on Iles' map of 1870, the coast line and hill features being taken from the Admiralty Chart of 1848. In his second map there are two insets: the first, of Anguilla and neighbouring small islands, prepared by Mr. Carter Rey of that island, based on the Admiralty survey of 1847; the second being a sketch map, showing the relative positions of the islands of the Presidency, and the neighbouring Dutch and French colonies.

The price asked for these maps is the very moderate one of 2*s.* 6*d.* net for each sheet, or they will be sent post free on receipt by the agents of 3*s.* 6*d.* for one map, or 6*s.* for both.

These maps are the clearest and most recent that we have seen of any of the smaller British West Indies. It may be suggested that other west Indian Governments may see their way to copy the example in this matter of St. Kitts-Nevis.

Bats in Jamaica.

Bats throughout the West Indies belong to different races as regards their food, some being fruit eating and others being insects eatihg species. The insect eating varieties are for the most part smaller than those which live on fruit. Their value as insect destroyers is considerable; they feed on mosquitos and many other insects which fly at night.

In an article in the Jamaica *Gleaner*, June 19, 1920, on the bats found in Jamaica, there is an interesting account of the numbers which inhabit the caves of the limestone districts. The writer states that as the island is composed largely of limestone, caves are of frequent occurance, and these caves are the abode of by far the greatea part of the bat populateon. Many caves are small, but not infrequently caves are found which are several miles in length. Some such have great subterranean chambers througn which rivers run passing compelete under some small mountain chain; others have a series of intercommunicating chambers through which a person may walk for hours without retracing his steps. It is in such places that innumerable hosts of these peculiar animals may be found, and it is no exaggeration to estimate their numbers in a single cave as 10,000 or 15,000 individuals.

In the caves are great piles of guano deposited by the bats. These deposits sometimes are fifteen or twenty feet thick, and are valuable as a fertilizer.

A SUCCESSFUL PLANTATION IN TRINIDAD.

The *Port-of-Spain Gazette*, July, 29, 1920, contains an interesting account of a visit of some members of the Agricultural Society, paid to the cacao and coco-nut estates, La Victoria and San Diego, on the invitation of Mr. G. G. Brown.

A notable feature was the manner in which the estates were kept free of grass and weeds. Another interesting point was the throughness with which the cacao plantation was forked and manured. All available vegetable matter had been turned down into the soil, including even branches from recent prunings after being chopped up. The visitors also learnt with considerable surprise that Mr. Browne employed a system of drastic root pruning in conjunction with forking, which he stated he had found from experience of great benefit to the cacao fields.

Great interest was manifested in the system of drainage into a tidal river. This was carried out by means of automatic sluices, or 'kokers'; as they are called in some places. These are automatically closed the rising tide, and again automatically opened when the level of the tide falls below that of the water in the drain, thus effectually excluding salt water, while permitting the escape off the land of superfluous surface water. By this means a large area of swamp land, which used to be inundated at high tide eight years ago, has been reclaimed, and is now planted with fine, young, bearing coco-nut palms, from which five pickings a year are made.

With regard to the crops produced, Mr. Brown said that the coco-nut crop did not fall far short of 400,000 nuts, and that the cacao crop averaged close on twenty bags to the thousand trees.

The whole plantatation was a practical demonstration of a carefully thought out system carried out with strick attention to details, the intensive cultivation proving its success by the results attained.

The Structure of Wood.

In The *Field* for July 10, 1920, reference is made to the increasing difficulty in the identification of timbers, arising from the additions to commercial timbers made from all parts of the world. To be able to recognize a plank of dressed wood requires, it is stated, great knowledge and experience, for although some woods, such as mahogany, letterwood, walnut, and a few others are well marked and easy of recognition, many are puzzling even to experts, owing to the absence of distinguishing characters. It is consequently not unusual to find in the market one kind of timber offered for another, and their acceptance sometimes results in disaster. Where the growing trees or the unbarked stems can be seen, there is practically no difficulty in identifying them.

Attention is called to a publication, recently issued from the Cambridge Univeristy Press, entitled 'A Guide to the indentification of our more useful timbers,' and prepared by Mr. Herbert Stone, Lecturer in Forestry at Cambridge, which seeks to remove some at least of the difficulties referred to above, and to render the identification of timbers more simple and certain. This book is intended for the use of students of forestry, though, as far as it goes, it will be more helpful, it is believed, to the users of timbers than to the growers. The structure of the wood is described. and a dozen sections (magnified) are figured, showing the differences in size and numbers of the rays, vessels, etc. It is admitted that, in addition to knowledge of this kind, a training got by the handling of many specimens is required. Even the characters relied upon in this work vary according to the age of the tree, and the conditions in which it has grown. It is suggested that a visit to a good museum of timbers, such as that at Kew, would be a help to the proper appreciation of how timbers vary.

The book (the price of which is quoted at 7*s.* 6*d.*) should be a help to students, who are recommended by the author to observe for themselves with its aid, the details of structure in the samples themselves, taking care that they are accurately named. For this he student had better go to the forester.

INSECT NOTES

THE GREEN PLANT BUG.

In a paper in the *West Indian Bulletin*, Vol XVI, p. 203 it was shown by Mr. W. Nowell, then Mycologist of the Imperial Department of Agriculture for the West Indies, that the green plant bug (*Nezara viridula*) was a source of considerable injury to the cotton crop by infecting bolls with fungus causing internal boll disease.

From an article in the *Quarterly Bulletin* of the State. Plant Board of Florida, April 1920, it would seem that this same insect is a serions plant and fruit pest in that State During the last ten years, it is stated, the insect has been greatly increasing in numbers, and the damage done by it is very considerable, not only in Florida, but in other States bordering the Gulf of Mexico.

It seems probable that the insect was originally a native of India, but it is now almost universally distributed throughout the tropical and sub-tropical regions of the entire world. As was noticed above, it is a cotton pest in the West Indies, and not only are its ravages reported from the southern American States, but it seems to have appeared in Australia also, and to be doing considerable damage on vegetable crops in the neighbourhood of Sydney.

Nezara viridula belongs to the group of insects commonly called true bugs, of the family Pentatomidae. The pentatomids are widely known as 'stink bugs' because they emit a very evil-smelling and ill-tasting substance, probably for protective purposes. Besides the name 'stink bug' and 'green bug,' the insect is known in the West Indies as 'bush bug,' and 'pea chink'.

The green bug feeds on many different kinds of plants. All parts of a plant are attacked, but it is particularly partial to the fruit and to tender growing shoots. Although this insect has been found feeding on a very large number of diffierent plants, it has been observed that it is particularly attracted to leguinenous plants In the West Indies it has been found particularly associated with the pigeon pea (*Cajanus indicus*), while in Florida it appears to be especially attracted by the cowpea (*Vigna Catjang*). It has also been observed in Florida that a species of Crotalaria is also markedly preferred by the Nezara.

The mouth parts of *Nezara viridula* are modified to form a structure adapted to piercing and sucking. This structure, known as the beak or rostrum, when not in use is folded flat, close to the ventral surface of the body, between the legs. It is an elongated, four-jointed, tube-like structure, containing four long lance-like sharp-pointed bristles, with which the insect pierces the tissues of plants, and extracts the plant juice by suction. The numerous punctures caused by the insect's beak make minute, hard, brownish or blackish spots on the plant. As has been proved in the case of cotton bolls in the West Indies, these punctures may very easily become an avenue for fungus or bacterial infection leading to decay.

Studies on the habits and life-history of this insect have been carried on at Florida. From these it would appear that eggs are deposited in clusters, mostly on the under sides of leaves The number of eggs laid by each female varied consiouably. The average number of eggs contained in forty egg clusters examined was a little more than eighty-eight to a cluster. The clusters were made up of from 46 to 126 eggs.

The minimum period for incubation was four days. The minimum time for the five nymphal instars was twenty-four days, thus only twenty-eight days elapse from the time the eggs are laid until the adult stage is reached. There appear to be four generations annually in the northern part of Florida, but there are probably more in warmer regions, as it was observed that development was more rapid during the summer than in the autumn or spring.

With regard to control of the insect, six predaceous enemies have been recorded as attacking it, the Florida predaceous bug (*Euthyrhyncus floridanus*) being the most important. In laboratory investigation three parasites of the adult insect, and two parasites of the egg have been reared. From observation it would appear that by the spread of these parasites this insect may possibly be controlled effectively.

Another method of control suggested is the planting of some leguminous plant—*Crotolaria usamaroeusis* is mentioned—to serve the purpose of a trap from which the insects might be collected and destroyed This plant also seems to be, owing to its flowers, very alluring to the parasites of the bug. It is recommended that, if a trap plant is used, the best method for collecting and controlling the insect is by hand picking. The habit of the insect when suddenly disturbed, or when the plant on which it is feeding is jarred, of dropping to the ground, renders hand collecting feasible. In fact it has been demonstrated that the bugs can be collected economically, when they are destroying or injuring fruit, by the use of quite large nets which are held beneath the plant or tree, and the bugs shaken into them.

SILOS AND ENSILAGE IN ANTIGUA

In the Report on the Agricultural Department, Antigua, for the year 1918-19, brief mention was made of the successful construction of three silos in that island. Information of a more detailed character, with regard to the working of these silos, has been recently received from Mr. A. E. Collens, Acting Superintendent of Agriculture.

The silos in question are located on three of Messrs. Henckell Du Buisson's estates, namely Cassada Garden, Fitches Creek, and Cedar Valley. They were erected of reinforced concrete in October 1918, under the superintendence of an experinced foreman who had been sent for the purpose from Trinidad.

Their dimensions are as follows:—

Height of tower internally from flour to under the eaves, 34 feet.

Internal diameter, 16 feet.

Thickness of concrete and reinforcement, 4 inches.

Reinforcement—pierced metal stayed with $\frac{1}{8}$ inch round iron rods.

Having been erected in October 1918, the silos were filled in April and May 1919. For the purpose of filling, a typhoon cutter blower, No.40 (made by Eagle Manufacturing Company) was used. This machine develops a speed of 800 to 1,000 revolutions per minute, with a two-knife cut, and was operated by an 8-inch pulley wheel driven by belting from a 10 h.p. Fairbanks-Morse horizontal oil engine, 350 revolutions per minute, with a 20-inch pulley wheel and 6-inch belting. A drawback to this type of engine is the cluching system; the clutch is apt to slip, which causes the blower to slow up, and not to create sufficient draught up the pipe, which is 5 inches in diameter; thus the pipe was frequently choked. Men are employed inside the silo in ramming and packing down the material during the process of filling; this is hot, disagreeable work, and commands high wages.

At Cedar Valley the silo was filled in April 1919, and the ensilage began to be used in September, and was finished by December 31. At Fitches creek the silo was filled in May 1919, and the ensilage began to be used on October 27. and was not completely exhausted on July 12, 1920.

The resulting ensilage is slightly acid, with an attractive, aromatic smell. Although the stock took some little time to appreciate it, it was soon readily and greedily eaten by them. Where the ensilage was not tightly packed, some rotting took place at the top and along the edges some distance down, but, where fairly tightly packed, only about 1 foot at the top was found to be rotten, and practically nothing along the sides. Some of the ensilage, from about 8 feet from the bottom and downward, still retained a slight green colour when opened.

The silage was fed to the stock on the estates, mixed with molasses and water, like ordinary cane top 'chop-chop', and no ill effects have been observed on the anlmals. The quantity fed to the stock was approximately 2 corn bags full to every six animals, or about 1 cubic foot, say 25lb in weight, of well pressed ensilage per animal—twice daily to cattle and mules, and once daily to horses. At Cedar Valley the silage provided food for fifty cattle, thirty-seven mules, and four horses for four months, although about one-seventh of the ensilage made was discarded as unfit for animals. At Fitches Creek, using the same quantity as mentioned above, from thirty to thirty-two head of stock have been daily fed from it from the time of its opening, and there still was about 4 feet of ensilage left on July 12.

The advantages of silos have been frequently brought to the notice of West Indian planters in the pages of the *Agricultural News*. It is satisfactory to note that, in Antigua at least, their construction and working seem to have proved successful for the first year. One wonders whether it might not be possible, on many estates where disused wind mill towers exist to convert them at comparatively small expense into efficient silos.

STOCK KEEPING IN ANTIGUA.

A copy of the report by the Government Inspector of Animals, Mr. H. Goodwin, M.R.C.V.S., on the general health of stock in Antigua for the year ended March 31, 1920, has recently been forwarded by the Colonial Secretary for the Leeward Islands to the Imperial Commissioner of Agriculture for the West Indies

The report is an interesting one, and, considering that the conditions under which stock are kept in Antigua are very similar to those obtaining in other parts of the tropics, especially in the smaller and drier West Indian islands, the useful information contained in it will doubtless be of value elsewhere.

Mr. Goodwin notes that weather favourable for cane growing is unhealthy for stock in Antigua, while a scanty rainfall is generally more favourable to the animals, and there is lees mortality among them. Too often, when wet weather sets in, no preparation has been made to meet the changed conditions, and the animals suffer in consequence. After rains the animals are often up to their knees in slush and manure in wet pens, no dry litter or food supplied to them, green grass containing too large an amount of moisture being their chief sustenance; these are factors not conducive to health.

Most cases of sickness among the animals observed during the year were due to want of proper care, bad conditions of pens, over work, and cruelty. It would appear that few stock keepers are capable and observant; and good herdsmen are rare. Consequently control of the grazing and the pens are too often left to careless employees, while the working of the animals is entrusted to callous and cruel drivers. Mr. Goodwin says that the cause of many deaths can be attributed to what he designates as 'inhumane brutality.'

There is a serious loss of stock on estates, not only from bad pen management, but from the fact that too few animals are kept for the necessary work. Young, unfit animals, which require a year or two more at pasture, are put to work, and are quickly overworked and so die.

In many cases the supply both of water and food is defective. It has been computed, Mr. Goodwin states, giving his authority, that cattle require 5 lb of water for every 1 lb. of dry matter they eat, or in other words, from 15 to 25 gallons a day; but in very many cases they do not get anything like this quantity.

Again many stock keepers do not realize the difference between the ox and the mule, with regard to capability or, continuous labour. With the mule digestion is unintermitted but the ox requires a period of rest after eating for the purpose of rumination or 'chewing the cud'. It often happens however, that an ox is put to work immediately after feeding, the result being that the food is passed from the rumen through the other cavities of the stomach in an indigestible form, affording little benefit, with the ultimate result of emaciation, weakness, and death.

In former years, at the end of the crop on estates a plentiful supply of green fodder and dried litter had been collected in stacks. This does not appear to be so at the present, and the consequence is that at the end of the year, what with inferior molasses, little or no concentrated foodstuffs, and not much fodder, the animals have a hard time. It seems imperative to devise some improvements on the present methods of stock keeping. The practical suggestions made by Mr. Goodwin are: (1) the creation of paddocks, (2) improvement of pasture and water-supply, (3) mechanical horse power, and (4) silos.

With regard to the first two of these suggestions, Mr. Goodwin leaves them undiscussed. With regard to the third, he only states that tractors and motor trucks have proved of valuable assistance in the work of the animals to those who have used them.

On the preceding page of this issue attention is drawn to the successful operation of silos on three estates in Antigua In his report Mr. Goodwin gives some valuable hints on this matter. He says that the fact of tops and trash being dry is no obstacle to utilizing them in packing silos. Dry straw has been chaffed and stored in silos for many years in England. More than twenty years ago Dr. Voelker, consulting chemist to the Royal Agricultural Society of England, showed that 70 per cent. of indigestible fibre was converted into digestible matter by the process of fermentation.

The system of ensilage of dry matter is slightly different to that when green stuff is used. The dry chaff needs the addition of a little moisture to encourage fermentation. This is effected in one of two ways. In England, about a hundredweight of some green matter is mixed with a ton of chaff. In America, water is added either directly into the silo, or into the blower. Apart from the advantage of having a store of fodder ready at hand in the silo, the system affords other benefits owing to the increased palatability and digestibility of the silage as compared with the dry material.

GLEANINGS.

In a letter to the Imperial Commissioner of Agriculture, dated May 17, 1920, Mr. P. H. Lamb, Director of Agriculture Northern Province, Nigeria, states that in tropical Africa, both East and West, the guinea bird is extremely useful in ranging far and wide through the cotton fields in search of cotton stainers (*Dysdercus* spp.) with which it will fill its crop almost to the exclusion of other food.

It is stated that some large tobacco plantations in Java have turned their land into cane fields and are growing cane which is to be sold to sugar factories in the vicinity. Although owing to the regulations, a large extension of cane plantings on new land is impossible, the use of tobacco lands is quite possible, and this may contribute to a rather good increase of the Java cane sugar production, and a combatment of the sugar scarcity. (*Louisiana Planter*, June 19, 1920.)

In an article in the *Bulletin of the Imperial Institute*, October-December 1919, on agriculture in Cyprus, it is stated that the prickly pear (*Opuntia* sp.) grows wild, and as a hedge plant in Cyprus, but no attempt has yet been made to use the stems as food for animals. In Sicily, however, very large quantites are so utilized. Successful experiments have been made by the Agricultural Department in Cyprus in mixing the juice of the stems with lime for giving brilliance and permenance to ordinary white wash. It may be mentioned that this is commonly done in some of the West Indian islands.

The Government of Surinam has for many years been trying to open a timber export trade on a large scale. In 1918 a director of a Dutch company, which has done much for the Demerara green-heart timber trade on the European market, visited Surinam. He reports that the poor condition in which Surinam timber often reaches Europe is due not to any defect in quality, but to bad handling As a result of his visit, a syndicate had been established which has lately obtained the right of prospecting a tract of land of an area of 900,000 hectares. (The *Board of Trade Journal*, June 17, 1920.)

During the past few years interest has been shown in the cultivation of sisal hemp or henequen in Peru, where the plant thrives under many of the desert conditions of the waste lands. Although only of from 3 to 4 per cent. of the leaves is available for fibre, there is no agricultural product of commercial value which can be produced at less expense, or in such barren ground. The Peruvian fibre, which is light cream in colour, straight, clean, and smooth, is used for the manufacture of cordage and binder twine, and is also used for bags, hammocks, and various other articles. The *Chamber of Commerce Journal*, July 2, 1920).

Seeds of water melon are being distributed free by Mr. Leschloupe in Port-of-Spain Trinidad. It appears that there is demand in New York for the ripe fruit, which he is prepared to buy from growers. There seems to be a chance for some people to make a little money if they wish by growing this fruit, says the *Port of Spain Gazette* June 18, 1920.

There are many oil-producing countries around the Caribbean sea. A note in the *Louisiana Planter* June 12, 1920, states that in 1918 Mexico shipped nearly 54,000,000 barrels of oil. In the same year Trinidad produced more than 1,500,000 barrels. The oil industry is also being developed in Venezuela, which produced 48,000 barrels in 1918. Cuba sold in 1917, 19,000 barrels of locally produced oil Explorations are being made with regard to the discovery of paying oil-producing strata in Honduras, Costa Rica, Panama, and Colombia, and also in the British colonies of Guiana and Barbados. It seems therefore likely that the Caribbean area will become in the future a very important source of petroleum for the world's market.

The flowers of *Acacia farnesiana* are largely used in perfumery, and the annual crop of the flowers of this plant in France is stated to be worth thousands of francs, and a particularly delicate fragrant perfume is extracted from them. The pods yield a fair amount of tannin, and from cracks in the bark there exudes a gum very like the true gum arabic. This plant is well known in many of the West Indian islands under the name of 'sweet briar' in Barbados, on account of its numerious thorns and the exquisite scent of its flowers, but under the name of 'stinking cossie' in Antigua, owing to the disagreeable smell of its wood; probably 'cossie' may be a corruption of 'Acacia'. (*Bulletin of the Imperial Institute* October-December 1919.)

Throughout Australia almost the only wood used for the manufacture of butter boxes is white pine. It has been estimated that 25,000,000 super feet of timber are annually required for butter boxes, and several million more feet are used in local match manufacture. Most of this soft wood comes from Queensland, where reckless destruction in clearing land of timber for farmiug purposes, and for supplying timber for trade purposes, has made such inroads on available supplies that reafforestation has become a pressing question. The Forest Service this year is preparing one million hoop pine plants for that purpose. (*Weekly Bulletin*, Department of Trade and Commerce, Canada, June 28, 1920.)

Half the world's total production of cacao goes to the United Statas. The imports of cacao into the United States for the year ended June 30, 1919, were 313,037,419lb., valued at $35,953,990. Since the war there has been a steady movement toward direct importation from the producing countries. Cacao from the Gold Coast formerly reached American ports via the United Kingdom. The tremendous increase that has occurred in the direct trade between this African colony and the United States is shown by the fact that the value of imports of this cacao rose from $888 in 1914 to $11,681, 338 in 1919. (The *West India Committee Circular*, June 24, 1920.)

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. LUCIA. During the month of July plant distribution comprised the following : 500 lime plants, 24 budded oranges, 11 ornamental plants, 20 lb lime seeds, 75½ lb. Indian corn, 51 packets vegatable seeds, 2 packets seeds of other economic plants. Work in the Experiment Station and Botanic Garden was of a general routine character. Regarding staple crops, Mr. E. Buckmire Acting Agricultural Superintendent, states that reaping operations in connexion with the sugar crop are all now completed, and everywhere clearing for extension of the area under cultivation is in progress. Weeding, draining, and supplying vacancies are continued, and the stand of the young cane crop generally is very satisfactory. The lime crop is now in full swing, and the Government lime juice factory is kept very busy. The quantity of limes brought to the factory during the month was 630 barrels of fruit and 2,396 gallons of juice; and the quantity of juice handled for the month was 7,439 gallons. Cacao is flowering profusely, but heavy winds have blown down the flowers, and shaken the trees very badly, except in cases where the trees are sufficently protected. The crop will be very late and small, if the weather continues unsettled. A meeting of the Committee of the Agricultural and Commercial Society was held during the month to consider (1) ways and means for dealing effectively with rat extermination, and (2) the food shortage, Throughout the month heavy winds were experienced, which blew off a considerable quantity of young pears and mangoes, and cacao and lime blossoms. The rainfall recorded at the Botanic Station, Castries, for the month was 11·89 inches; as the Botanic Station, Choiseul, 7·21 inches.

MONTSERRAT- Mr. W. Robson, Curator, writes to say that the rainfall was sufficiently satisfactory during the month of July to allow part of the Experiment Station to be planted in crops. Plant distribution during the month included 2,100 bay plants, 7,200 sweet potato cuttings, and 200 packets of various beans. Three distillations of bay leaves were made in the Botanic Garden with the usual results. Several thousand bay seedlings were transplanted into nursery beds and 125 camphor plants potted. While the total rainfall during the month has been satisfactory for the cotton crop, a good soaking rain has not yet been experienced. Previous to the rains, a large area of cotton on the stiffer soils had developed rust, and in most cases the plants were partly defoliated. On these areas there has not been the same response to the rains in July, as shown by the plants on the lighter soils. The possibility of even an average crop of cotton would seem to depend on there being a fairly ample rainfall during the next few weeks. With the exception of the rust above referred to, the cotton plants have been remarkably free from pests and diseases. The rainfall recorded at Grove Station for the month was 4·89 inches, making a total of 21·13 inches for the year to date.

ANTIGUA. Both sugar factories, Mr. A Gallwey states, ceased operations during the month of July. From 94,077 tons of cane crushed at Gunthorpes Factory, 10,639 tons of crystals were obtained. This means that this factory took 8·84 tons of cane to make 1 ton of sugar. At Bendals Factory 23,491 tons of cane were crushed, which yielded 2,450 tons of crystals. This factory therefore, took 9·58 tons of cane to make 1 ton of sugar. The outlook for next season's crop is a very gloomy one. It is now seven months since estates have planted their crops, and although the young shoots look green, no cane has been formed. During the month there was a shortage of cane plants The young cotton crop is feeling the drought terribly. The germination of seed has been poor in some localities. Three plots of 1 acre each were allotted to peasants on Sawcolts during the month, under the Land Settlement Scheme.

One General and one Committee Meeting of the Antigua Agricultural and Commercial Society were held during the month. At the General meeting, held on the 2nd, the Acting Superintendent of agriculture spoke at length on the serious shortage of foodstuffs, and the necessity of increased food production locally, urging planters to grow as much vegetables as possible. As a result of this meeting, the local Department has been asked to order 2,000lb. of black-eye peas from Trinidad for planting purposes. At an 'At Home' held by the above Society on the Deanery grounds on July 16, occasion was taken to present an address from the people of Antigua to Hon, F. H. Watkins, I. S. O., in recognition of his services as Acting Colonial Secretary of the colony. Plant distribution for the month included 20lb. Guinea corn seed, 30 packets miscellaneous vegatable seeds, 1 packet *Prosopis juliflora*, 1 packet seeds of balsam of Peru (distributed); and 315¼lb. selected cotton seed for planting purposes (sold). One hundred and twenty-five channels and fifty-four nests of termites were destroyed in the Botanic Garden during the month by treatment with white arsenic, which seems very effective on this pest. The rainfall recorded for the month was 1·22 inches; for the year to date, 12·74 inches.

ST .KITTS Agricultural operations in the Experiment Station were at a standstill during the month of July, owing to the prevailing dry weather, the crops planted barely keeping alive. In the Botanic Garden some trees have died from drought, and have been removed: there is no water available for watering except the young plants in nurseries. Regarding staple crops, there is little to report, Mr Shepherd says, beyond the continuation of the drought. The condition of the cane crop all over the island is a very serious one, and unless the drought breaks up soon, the outlook is grave · The cotton crop in the Northern district is being rapidly reaped, but the return will be very poor. The outlook in the Valley district is also disturbing, but if the rains set in there is still a chance of fair returns. So far, there has been no trouble from pests on cotton, beyond a little leaf blister mite in an advanced field. A new lime-kiln has been erected near Brimstone Hill, by private enterprise, which is doing excellent work, and supplying a long needed want. At a meeting of the Agricultural and Commercial Society, held on July 3, a resolution was passed in favour of the importation of two stud horses. The rainfall for the month was 2·10 inches; for the year to date, 17·33 inches.

Miss Mc. Clean, the Herbarium Assistant at the St. Clair Experiment Station, Trinidad, may be credited was having rescued, under the instruction of the late Mr J. H. Hart, from destruction an invaluable collection, of botanical material left by former botanists of the Agricultural Department. The specimens are now properly mounted and arranged for reference. Dr. W L Britton, Director of the New York Botanical Gardens, expressed himself, during a recent visit to Trinidad, as agreeably surprised and pleased with the efficiency of the collection, and the richness in numbers of invaluable botanical specimens which he met with in the cabinets of the Herbarium.

COTTON NOTES

SEA ISLAND COTTON MARKET.

The report of Messrs W. Frost & Co., on Sea Island cotton in the Southern States, for the week ended July 3, 1920, is as follows :—

ISLANDS. Since our circular report of May 22, the market bas remained dull, with no demand for the limited stock of 102 bales, consisting principally of small crop lots of Extra Fine held at $1·15 to $1·50. The English and French spinners seem to be supplied until the next crop, and there is no demand on account of the Northern Mills for cotton having the staple and fineness of the above crops.

GEORGIAS AND FLORIDAS. The Savannah market has remained very dull also, with no demand for the offerings, which are held at very high prices, but we do not think anyone is interested at the prices asked. The Northern Mills are apparently supplied for the present and consequently show no interest

The unsold stock of about 2,000 bales is held partly by exporters and partly by factors on account of interior merchants.

We quote, viz. :—

Fancy nominally held at $1·25 f.o.b. and freight.

Extra Choice nominally held at $1·23 f.o.b. and freight.

The exports from Savannah since May 22 have been, to Northern Mills 280 bales and from Jacksonville to Northern Mills 382 bales.

CROP ADVICES. On the Islands and coast of Carolina the acreage has been very much reduced on account of the boll weevil, and it is estimated that the crop will not exceed 1,000 bales The weevil has appeared very generally, and planters are applying the poison recommended by the Government. In some instances they are pleased with the effect of the poison, but feel apprehensive as to the final outturn.

In Georgia a very small acreage has been planted. Recently the weather has been favourable, and the crop is making good progress.

In Florida there is some increase in acreage over last year, the high prices having induced the planters to run the risk of the ravages of the boll weevil. The weather in this State, however, has not been very favourable during the past month.

With no serious injury from the weevil and with an average season the crops of Georgia and Florida may possibly amount to 8,000 bales but this is considered a very full estimate.

METHODS OF TESTING CACAO BEANS.

The following notes have been contributed by Mr. T. W. Clark, Trading Mananger in Grenada for Messrs. Rowntree & Co., Ltd., the-well known cocoa manufacturers in England. The notes should be of interest to cacao planters as exhibiting the point of view taken by large cocoa manufacturers with regard to the quality of the raw product they purchase.

THE PREPARATION AND CURING OF THE BEANS.

The ultimate aim in the growth and preparation of cacao beans, is to give the finest possible flavour in the manufactured cocoa or chocolate. Beyond the question of securing a satisfactorily heavy crop, it is this ultimate objective (the flavour) which is the justification of the care in the choice of seedlings, the drainage and manuring of the soil, the protection of the soil, the careful picking of only those pods which are fully ripe, the lengthy period of fermentation, and the thorough drying as a preventive against mildew as advocated by the best authorities.

From the manufacturer's point of view, perhaps the most important process in the preparation and curing of the beans, is fermentation. It is by fermentation that the bitter taste is eliminated, and consequently chocolates or cocoa manufactured from fully fermented beans attain the highest standard in point of flavour.

The objection is sometimes raised that fermentation results in great loss of weight. This is erroneous. The loss of weight resulting from fermentation and drying is not materially greater than the loss from drying only, provided always that the drying is complete. If the beans have not been reduced in weight by very complete drying, it follows that the cacao is not in a fit condition for shipment, and buyers may justly decline to complete a purchase until the drying is made thorough.

The process of trampling the beans is useful in rendering them more impervious to mildew. No accessories, excepting only a little fresh water, should be used either in curing, trampling, or drying cacao beans. Such things as orange juice, oils, or lubricant from the cacao pods are quite bad. They encourage mildew, and also attract rats, which do great damage. If the beans have been subjected to full fermentation, turned several times during the process, trampled, and thourghly dried off, no other precaution is necessary or likely to serve any useful purpose. The practice of claying the cacao is useless, and is objected to by the English manufacturers.

THE OUTSIDE APPEARANCE OF THE BEAN.

This is only important in so far as it affords indication of what the inside of the bean may be like. Such ideas as producing a 'pretty' cacao, a 'bright' cacao, etc., are quite wrong. The sole benefit of trampling is to strengthen the outer shell, thus giving a little extra protection against cracking and mildew. In manufacturing cocoa or chocolate, the outer shell of the bean is blown away by a current of air, and then collected and sold at a very low figure as a by-product. It is the inner portion of the bean only which becomes cocoa or chocolate. At the same time it should not be forgotten that a cacao buyer is, after all, quite human, and a grower who dries the beans on a sheet of galvanized iron, giving them the appearance of charcoal, should not be surprised if the buyer is prejudiced against what may really be quite good cacao.

THE SIZE OF THE BEANS.

In a general way 'mountain' cacao, i. e. cacao grown at a height of 500 feet and upwards, gives a larger bean than cacao grown on the low-lying lands of Grenada. The same estate, however, is found to offer beans varying in size, and this is sometimes an indication that picking has been done before the beans were fully ripe. At the end of the crop the beans become smaller in size, and are of lower value, as such beans will give a smaller percentage of manufactured cocoa.

BAGGING THE CACAO.

Before the beans are placed in the bags, it is well worth while to make a careful inspection. Not infrequently the value of a bag of cacao is lessened by omitting to remove twigs, leaves, false beans, etc. The beans should also be cleaned in a good current of air. Some growers, in haste to effect a sale, bag up the cacao whilst still hot from the sun. This gives the beans a 'misty' appearance, and unless they are turned out and thoroughly aired, mildew will set in and speedily permeate the beans.

TESTING THE BEANS.

The tests which may be applied to cacao beans are divisible into two classes —

(a) Tests of small samples, usually about a handful

(b) Tests of full bags.

The following are the methods by which tests may be effected.

Small Samples. (1) The beans should be cut open with a knife. If full fermentation has occurred, the inside of the bean will be of a light chocolate colour, and the veins or 'heart' of the bean will be of the same shade as the rest. If these veins are still white, or lighter than the other parts of the bean, fermentation has not been complete. If the bean is purple inside, that also is an indication of incomplete fermentation. A 'slate' colour is the sign of an unfermented bean. Sometimes the inside is found to be quite raw in appearance, like the inside of a bean when it is first taken out of the pod. This 'raw' appearance seems to be due to to the pods having been picked before they were thoroughly ripe, and no amount of fermentation will bring these beans up to the best grade.

(2) The beans should be picked to pieces with the fingers, breaking first into the broader end of the bean, where the heart will be found. As mentioned in (1), if the heart is white or lighter coloured than the rest of the bean, it is not entitled to pass as first grade. When broken, the beans, if full fermentation has taken place, should readily crumble into fragments. If not fully fermented, the fragments will have a tendency—more or less pronounced—to cling together, and the bean will not readily disintegrate. This unsatisfactory break will also be noticed in beans which have been dried and afterwards refermented; such beans will never come up to the first grade. Some samples vary considerably owing to the beans not having been turned in the sweating boxes, resulting in different degrees of fermen tation in different parts of the heap.

(3) Take a handful of the beans, and, if fully fermented it will be noticeable that the beans feel of a lighter character than unfermented beans.

(4) The beans should be rubbed between the hands to generate heat. If fully fermented, they will then give off an acid aroma. This is not one of the best tests of a small handful only. It is, however, a good test as to the presence of mildew.

(5) Taste the beans after removing the outer shell. A well fermented bean will readily disintegrate in the mouth, and the flavour will be wholesome and nutty, with something like the taste of manufactured chocolate. There should be no suggestion of the bitter taste caused by insufficient fermentation, and none of the mustiness caused by mildew.

Full Bags of Beans. (6) Let the bag fall on the floor. Fully fermented beans will give a crisp, light sound, distinctly different from the heavy 'sag' of a bag of ordinary cacao.

(7) Thump the bag. The same difference of crisp, light sound will be noticeable with the fermented cacao, as against the duller sound of 'ordinary'.

(8) Open the bag, and test the beans by hand as mentioned in (3).

(9) Run the fingers through the beans and notice the different sounds. Fermented beans will rattle like marbles, whereas 'ordinary' cacao will sound very dull.

(10) Turn the beans out on to the floor. If they are fully fermented, the 'vinegar' aroma will be immediately noticed, and the acidity can also be tasted, even if one is standing a little way from the beans.

(11) Sometimes the beans feel quite 'cold'. This is often an indication that although thoroughly dried. the beans have been stored in a cold and possibly damp place. It is well to take the precaution of turning them out and allowing the air to pass through them for a time.

(12) An important point is that beans which have been cut open or picked to pieces for examination should not be returned to the bag, as these broken pieces mildew very quickly, and the mischief may easily spread.

CONCLUSION.

The necessity for a full period of fermentation cannot be too strongly emphasized. One result of the tremendous increase in the consumption of cocoa and chocolate is that the taste of the general public is now keenly critical, and manufacturers are more and more giving preference to cacao beans which, by reason of the care exercised in curing and drying, give the opportunity of attaining the highest standard in the manufactured article.

AGRICULTURE IN BARBADOS.

July has been up to the present a month of frequent showers The rainfall for this particular month has been the best on record since 1917. Although the rains have not been heavy, yet the earth has had sufficient moisture to keep the crops growing. Generally speaking, it can be said that the weather this month has been very favourable.

The young canes in the red soils are making wonderful progress. The black soils have not had sufficient rain to induce such a rapid growth, but they are yet promising. Farmyard manure is being spread in certain weak spots of canes and ratoons.

Considerable progress has been made with the tillage of fields for planting this year, and many fields of cane-holes have been dug. The plough has also done a fair amount of work, thus relieving the most of the men for cane hole digging.

The supplying of the young crop still continues. Where ratoons are very thick and healthy, it would be advisable that some of the stools for supplying be taken from them, instead of resorting to unhealthy, hard ones in the fields to be tilled. Planters would do well to mould up as many of their ratoons as they can. The mould causes fresh shoots to burst, and pro'ects the stumps. This work is regularly done on most estates, and the result is most gratifying.

The yam and eddoe crops have been nearly all planted, and there can now be seen promising fields of yams; the spires are large and healthy. Progress has been made with fields for potatoes, and where cuttings could be obtained they are growing nicely. The Indian corn is also recovering, and some fields are good and healthy.

It is a great pleasure to see how industrious the peasant folk are. There is hardly to be seen a spot in the tenantries lying waste where something can be planted; their little plots are nicely kept, and look beautiful.

In the country districts, the hillsides and pastures, which a few weeks ago looked so burnt and tiresome to the eye, are now covered with shrubs aud grass. Already a few estates are beginning to cut some fodder, a welcome change to the cattle from dried cane tops and trash after a hard day's work.

Several plots are now being prepared for the purpose of planting grass, and every advantage is taken of the showers in cultivating and planting them. (The Barbados *Agricultural Reporter* July 24, 1920.)

MARKET REPORTS.

London.—The West India Committee Circular June 10.

Balata—Venezuelan Block, no quotations; West Indian Sheet, 4*s.* 3½*d.* c.i.f., spot, 4*s.* 6½*d.* to 4*s.* 7*d.*
Beeswax—No quotations.
Cacao—Trinidad, 135*s.* to 140*s.*; Grenada, 100*s.* to 116*s.*; St. Lucia, and Dominica, no quotations; Jamaica, 115*s.*
Copra—£53
Honey—75*s.* to 105*s.*
Lime Juice—Raw, No quotaions Concentrated, no quotations.
Pimento—5½*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T. S. Garraway & Co., August 4.

Arrowroot—$8·00 per 100 lb. duty paid.
Cacao—Lottings at 22c.
Coco-nuts—$52·00 husked nuts.
Hay—Sales at $6·00.
Onions—Lottings at $13·00.
Peas, Split—No quotations; Canada, $12·50 small, $15·00 large.
Potatoes—Market bare.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, June 22.

Bay Oil—30*s.* to 32*s.*
Lime Oil—7*s.* 6*d.* to 7*s.* 9*d.* for West Indian distilled, and for hand-pressed 27*s.* 6*d.* per lb.
Orange Oil—West Indian, 40*s.*

Trinidad.—Messrs. Gordon, Grant & Co., July 7.

Cacao—Venezuelan, $24·00 Trinidad, $17·00.
Coco-nut Oil—$2·35 per gallon.
Coffee—Venezuelan, 24c. per lb.
Copra—11c. per lb.
Dhal—No quotations.
Onions—$4·00 to $5·00 per 100 lb.
Peas, Split—$12·00 per 100 lb.
Potatoes—English, $8·00 per 100 lb.
Rice—Yellow, $14·50 White, $15·00 per bag.
Sugar—No quotations.

New York.—Messrs. Huth, Gillespie & Co., Inc. July 10.

Cacao—Caracas, 17c. to 17½c.; Grenada, 16c. to 16½c.; Trinidad, 16c. to 16½c.; Jamaica, 12c. to 13c.
Coco-nuts—Jamaica selects, $55·00 per M; Trinidad $5·00 per M; Jamaica, $37·00; Trinidad $35·00 per M. culs
Copra—9¼c. to 9½c.
Coffee—Jamaica, 16c. to 20c. per lb.
Ginger—36c. to 40c. per lb.
Goat Skins—Jamaica, Antigua, Barbados, St. Thomas and St. Kitts 90c.
Grape Fruit—Jamaica, $4·50.
Limes—$12·00
Mace—35c.
Nutmegs—24c.
Oranges—$5·50c.
Pimento—8¾c. per lb.
Sugar—Centrifugals, 96°, 17½c.; Muscovados, 89°, 15½c.; c. & f., Molasses, 89°, 15½c.

Special Selected Sea Island Cotton Seed

— FOR —

PLANTING PURPOSES.

We can supply you with the above, selected from Seed grown at the Government Industrial Schools, and the Lunatic Asylum Farm, under the supervision of the Agricultural Department. Lint from this Seed has been highly reported on by the Spinners in England.

WE SOLICIT YOUR ORDERS.

The Barbados Co-operative Cotton Factory, Ltd.

WHITE PARK.
May 15, 1920.

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West India Committee, 15, Seething Lane.
Barbados: Advocate Co., Ltd., Broad Street, Bridgetown.
Jamaica: The Educational Supply Company, 16, King Street, Kingston.
British Guiana: The Argosy Co., Ltd., Georgetown.
Trinidad: Messrs. Muir-Marshall & Co., Port-of-Spain.
Tobago: Mr. C. L. Plagemann, Scarborough.
Bahamas: Mr. N. D. Sands, Board of Agriculture, Nassau.
Grenada: Messrs. Thos. Lawlor & Co., St. George
St. Vincent: Mr. Floris Simmons, Experiment Station.
St. Lucia: Mr. R. W. Niles, Botanic Station.
Dominica: Mr. W. G. Hutton, Botanic Garden.
Montserrat: Mr. W. Robson, Botanic Station.
Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre.
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 801, Yonge Street, Toronto

AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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The Science of Cultivation.

THE word cultivation is often used in a broad sense including the whole process of crop production. In the following article it is, however, restricted to denote the preparation of the land for the future planting of crops.

From prehistoric times man has prepared the soil for crop production by the use of implements, first, hand implements, such as the spade, fork, rake and hoe, and, later on, animal-drawn implements, such as the plough and the harrow. Up to quite recent times no further development in the power employed in propelling these instruments of cultivation was possible beyond this manual and animal force. About the middle of the last century, however, the power of steam was utilized, and steam ploughs became a factor in cultivation. In the last few years the development of internal combustion engines has rendered the employment of this power possible in the case of many other and lighter implements of cultivation than the plough. In fact it may be said that the present problem of cultivation is that of providing suitable machinery for drawing cultivation implements on the land.

The urgency of the problem has been recognized by the British Board of Agriculture, which in May 1919 appointed a Committee to 'arrange for the testing, adaptation, and improvement of machines likely to prove of value to agriculture, to examine inventions and new devices, and to advise as to the further steps which should be taken to promote the development of agricultural machinery.' The report of the Committee has recently been issued, and is full of valuable information to agriculturists all over the world.

The well-known conservatism of farmers and planters which makes them chary of adopting new methods or new labour-aiding devices, is perhaps due to a great extent to their unfavourable financial position in the past, as well as to the influence of tradition and social environment. At the present moment agriculture is passing through a period of change. The agriculturist is, on the whole, in a much better position to purchase new machinery than he has been for many years, and the upheaval caused by the war has done much to modify his outlook.

Among those who gave evidence before the Committee referred to above was Dr. E. J. Russell, F.R.S., the Director of the Rothamsted Experiment Station, whose remarks and suggestions seem particularly worth the attention of agriculturists everywhere. As

Dr. Russell said, the urgency of the problem of providing suitable machinery for cultivation is indicated by two considerations: (1) the shortages of skilled manual labour, (2) the great increase in the cost of agricultural operations, which increase does not seem to be likely to diminish in the near future.

The advantages of the use of agricultural machinery for cultivation are, amongst other things: (1) increased output per man, (2) increased interest to the best labourers and boys, inducing them to remain on the land, (3) a great increase in the power of carrying on work whenever it is found to be most advantageous. A tractor can do so much more work than a horse that by its employment it is possible to get ploughing, for instance, done at the very time which is most favourable.

Dr. Russell pointed out that at present there was no exact basis of knowledge to go upon in connexion with agricultural machinery, so that it was impossible to lay the exact requirements of the farmer before the implement maker.

Every agriculturist knows in a general way that he wants to improve the tilth of his land, but that does not convey much information to the engineer, and consequently, without more precise information, empirical methods of testing machines have to be relied on, which are unsatisfactory.

It is probably not generally realized that the basis of cultivation, in the sense of the word defined above, is still empirical. As Dr. Russell points out, cultivation is now, so far as the science of it is concerned, in the position that manuring was in 1840. Then the art of manuring was tolerably well advanced, and men knew in a general way that if they put certain substances on their soils they would get certain results; but they did not know why they got these results and consequently no chemical manufacturer was able to help them much. As the result of experiments started at Rothamsted in 1840, and continued later on, it became possible for the agricultural expert to state to the chemical manufacturer that he wanted such and such substances, and the chemical manufacturer was able to ascertain how he could produce those substances in the best and quickest way.

What is wanted now is to bring the science of cultivation to such a scientific position that the agriculturist can tell the engineer, as precisely as he can tell the chemical manufacturer, just what his needs are; the engineer will then be able to provide much more exactly than he can at the present time the absolutely suitable implements.

There are directions in which information is wanted by engineers and implement makers. With regard to cultivation, it is known in a general way that a crumb-like structure of the soil ought to be got in order to secure a good tilth, but the causes that produce this desirable condition are not really known, although some information about them has been obtained. If these causes were better known, more definite information on the present methods of cultivation could be given, and ways in which these methods could be improved could be pointed out. In order therefore that the science of cultivation may be developed, it is necessary to secure a very full knowledge of the physical forces involved. Probably all the physical information wanted for the science of cultivation has been obtained by physicists, but the work of bringing it together from the agricultural point of view is the present need.

Further, it is necessary to know much more than is at present known about the cohesive power of soils, and the way in which this is related to the mechanical composition and other properties of the soil.

Lastly, the effect of various factors, such as the quantity of organic matter, the amount of water present in the soil, and the composition of the soil, on its cohesiveness, and its resistance to the passage of implements, and on the facility with which it will attain a tilth are necessary to be known.

All these problems involve scientific experiment, which, if carried out properly, would give a great deal of invaluable information as the basis of the science of cultivation.

Having secured the necessary knowledge as the basis for the science of cultivation, the next step would be practical work, where an endeavour would be made to find out the best kind of machine to produce the effect found to be desirable. This work would probably develop in the same way as the science of manuring developed. In this case no progress was possible until chemistry advanced, and until the nutrition requirements of plants had been worked out. In the science of cultivation, therefore, the first step will be the determination of the physical constituents of the soil; the next, the question of tilth; and, finally, the problems presented by specific implements of cultivation. Until the first step is accom-

olished, it is not possible to say what is the best kind of tilth, or which is the best type of plough, or even whether some better type of implement can be devised. On the other hand, it will be possible with a fuller knowledge of the constitution, to investigate the mechanical effect of the soil on a tillage implement.

Utimately the soil physicists should be able to assist the agricultural engineer by giving a specification for the design of any particular implement to meet any particular condition of soil. Agricultural implements are designed to meet a hundred different kinds of conditions which are the result of the interrelation of perhaps half a dozen factors. The work of the soil physicists would consist in analysing those factors, and reducing them to some sort of formula. He will then be able to give the engineer the equation expressing the relation between those sets of factors.

RAT DESTRUCTION.

A note in the *Journal of the Ministry of Agriculture*, June 1920, again draws attention to the necessity for energetic measures to be taken for the destruction of rats and mice. Both from an economic and a sanitary point of view, it is highly desirable that these pests should be ruthlessly exterminated. The Rats and Mice (Destruction) Act, of 1919, placed power in the hands of local authorities to carry out effective measures for the destruction of these pestiferous rodents. It is primarily a matter for local effort, and already many county and borough authorities in England have shown praiseworthy energy. For instance, there is a record of 60,000 rats destroyed in Nottinghamshire in seven months, and of 41,000 in the North Riding of Yorkshire, and 80,000 in Hertfordshire during a period of four months.

It would seem that if co-operative measures were taken in any one of these smaller West Indian islands, owing to the fact of their limited area, and consequently the possibility of guarding against renewed infestation from abroad, it ought to be possible to exterminate rats and mice.

It may be mentioned that a research laboratory has now been established by the British Ministry of Agriculture with the object of endeavouring to discover rat poisons that are not injurious to domestic animals. The aid of science is also enlisted to improve the poisons already in use.

One of the poisons containing squills or barium carbonate should be used, unless there is no danger to other animals or to human beings, when the use of stronger poisons, one of the standard phosphorus preparations for instance, may be efficaciously employed.

To those who may desire to make their own baits, or to have them prepared by local chemists, the following recipes may be found useful:—

1.	Barium carbonate	6	oz.
	Meal	16	,,
	Dripping	4	,,
	Salt	½	,,

This makes 1,000,000 baits of 6 grains each (i.e. pieces as large as a hazel nut).

2	Barium	4	oz.
	Biscuit meal or plain meal	4	,,
	Oil of aniseed	5	drops

Mix with fat to a paste, and lay out in pieces the size of a hazel nut in places where rats are known to be present

3.	Tallow	50	per cent.
	Barium carbonate	50	,, ,,

Mix with dripping to a thick paste, and spread on cubes of bread the size of dice.

4.	Squills, red powdered	20	per cent.
	Bread	30	,, ,,
	Fat	30	,, ,,
	Syrup	20	,, ,,
	Oil of aniseed	6	drops

Crumble the bread, mix ingredients to paste, and apply as in the case of numbers 1 and 2.

POTASH RECOVERY AT CEMENT WORKS.

Considering the great importance of potash as a manure for increasing crop production in all agricultural countries, the discovery of yet another profitable source of potash is not without interest.

In the October 1919, issue of the *Chemical Age*, Vol. I, No. 16, is published an article by Alfred W.G. Wilson, Ph.D. on potash recovery in cement works. Investigations were carried out by Wilson in the United States on behalf of the Canadian War Trade Board. Previously several potash recovery plants had been established in the United States cement works In those works where the recovery equipment was installed three years or more ago, the principal source of revenue during the last year of the war was potash recovery. Recently the first Canadian recovery plant was installed at the Canada Cement Company's works at Port Colborne, Ontario, on Dr. Wilson's recommendation.

The source of potash lies in the raw mixture used in the manufacture of Portland cement, which contains small quantities of silicates of the alkali metals. During the burning of the cement, it is estimated that approximately one-half of the total potash in the raw materials is volatilised, and collects as a crust, rich in potassium sulphate, on the walls of the kiln stack. There is some escape however, of very fine flue dust which also contains potassium compounds. Formerly, this dust was allowed to escape into the atmosphere, where it proved a frequent source of annoyance to fruit growers and the like, whose estates lay in the vicinity of the cement works. In the recovery process, the flue dust is collected, either by electrical precipitation or by the use of settling chambers and water sprays. The potassium salts are obtained by water extraction and evaporation from the recoveaed flue dust, and are placed on the market as a high-grade form of potassium fertilizer

DEPARTMENT NEWS.

Mr. F. Hardy, M.A., Dip. Ag. (Cantab.), Chemist on the Staff of the Imperial Department of Agriculture for the West Indies, arrived by the R.M.S 'Quilpue' on August 19 to take up the duties of his office.

Miss. E. M. Wakefield, Mycologist on the Staff of the Royal Botanic Gardens, Kew, has been appointed to act temporarily as Mycologist on the Staff of the Imperial Department of Agriculture for the West Indies. Miss Wakefield is expected shortly to arrive in Barbados from England.

THE BASSIA OR MOWRA TREE.

There are very few plants of which the corolla forms a valuable article of food for millions of people. One such plant, however, is the Bassia or Mowra tree of India. This tree belongs to the same botanical order (Sapotaceae) as several well-known West Indian trees, such as, the sapodilla, the star apple, and the 'mammee sapote.'

An interesting article on this tree and its products appeared in the *Bulletin of the Imperial Institute*, July-September 1919, from which the following is chiefly taken.

Of the three species of Bassia commonly met with in India, the principal one is *B. latifolia* (Roxb.), indigenous to the forests of Central India. It is known by the vernacular names of 'mowra,' 'mahua,' "mohoura' and 'mohwa.' In South India and Ceylon its place is taken by *B. longifolia*, which is put to the same economic uses. The third tree is *B. butyracea* of the sub-Himalayan tract, known as the Indian butter tree.

The seeds of these trees yield an important commercial product in the form of the valuable edible fat known as Illipe butter, largely employed by the natives as a foodstuff. Before the war the export of seeds to Europe was considerable, being mainly utilized in Germany and Belgium for the manufacture of margarine, soap, candles, etc.

Amongst the native population of India the chief importance of the mowra tree lies in the flowers, which are rich in sugar and highly valued as a foodstuff and as the source of a spirituous liquor. Some conception of the value put upon the flowers for these purposes by the natives is gained from the estimate made thirty-three years ago, that in the Central Provinces over 1,000,000 people, use the corollas of the mowra as a regular article of food, each person consuming about 80lb per annum. In the Bombay Presidency they are also used for domestic consumption on a large scale, and throughout India they are looked upon as a valuable reserve in famine years. The flowers of *B butyracea* are not eaten, but a syrup prepared from them is boiled down, yielding a sugar about equal in quality to date sugar.

The mowra tree sheds its leaves in February, and the flowers appear in March and April, at which time the ground beneath the trees is carefully cleared.

The flowers have a thick, juicy, globe-shaped corolla, of a pale cream colour, enclosed at the base in a velvety chocolate-coloured calyx. The corollas fall in the early hours of the morning, and are collected by the women and children. They are spread out to dry on mats in the sun, when they wither to half their weight, and devolop a brownish-red colour. In some cases the flowers are collected before they drop, and in many places it is the practice to remove only the corollas, leaving the pistil to ripen a fruit. A tree will yield 200 to 300 lb. of flowers in a year.

When fresh, the flowers are extremely sweet, with a peculiar pungent flavour and a characteristic odour. When dry the peculiar pungent flavour is less perceptible, particularly if the stamens are removed, and the flavour then resembles that of figs. The flowers are eaten either fresh or dried, and cooked in many different ways, with sal seeds, rice, shredded coco-nut, or flour.

The greater portion of the crop of flowers is used for the preparation by fermentafion of daru or mowra spirit. The native spirit has an offensive butyraceous odour, and is rich in fusel oil, one sample examined containing 3 per cent of fusel oil. In England it was found that over 6 gallons of proof spirit could be obtained from 1 cwt. of the flowers.

The composition of the flowers has been investigated at different times, and, the total amount of sugar recorded in the flowers of *B. latifolia* varies from 40 to 70 per cent. The quantity of cane sugar recorded varies from 3 to 17 per cent. and that of invert augar from 40 to 53 per cent.

Thirty years ago attention was directed to the richness of Bassia flowers in sugar, and the possibility of their being used in India as a source of sugar for export; but when it was established that except for a very slight proportion, the sugar was uncrystallizable, and therefore of little value except perhaps as a brewing sugar, the interest from this point of view died down.

During the war interest was centred in the production of acetone from Bassia flowers in India to supply the local demand in connexion with the manufacture of munitions, and it has been alleged that the yield from the flowers of *Bassia latifolia* was one-tenth of their weight or nearly ten times as much as is obtainable by distilling wood. The demand for acetone in India in peace times would not be large enough to justify the available supplies of flowers being entirely devoted to the manufacture of that product, but there remains the possibility of their being used for the manufacture of industrial alcohol. Derived from a forest tree, the other products of which are also of considerable economic value, they appear to represent an exceptionally cheap source. The yield of alcohol from the flowers is high compared with that from potatoes and other materials commonly used. It has been stated that about 90 gallons of 95 per cent. alcohol is obtainable from 1 ton of driedflowers.

In view of the extended use that is now being made of alcohol for power purposes, it seems likely that the most profitable way of utilizing the flowers would be as a source of a mixed motor spirit of the 'natalite' type for local use in India.

It has been computed that, in Hyderabad at least, the total cost of collecting and drying the flowers and delivering them to a factory in the zone of growth amounts to £1 10*s.* per ton.

It has been estimated that in the Hyderabad State alone there are already sufficient Bassia trees for the production of 700,000 gallons of proof spirit per annum, in addition to that necessary for the local liquor requirements.

In addition to the question of the production of alcohol from the flowers, and the value of the seed as

a source of oil, the flowers form a valuable food for the natives, particularly in famine years. The tree is well adapted to withstand drought, and is specially suited for planting on dry and waste lands, where little else will grow.

The tree takes about twenty years to produce flowers and seeds in large quantity, but during this period the land need not be entirely unproductive if interplanting were adopted at first. Experiments conducted in Assam during the past ten years have shown that, owing to the long tap root, the Bassia seedlings do not transplant well, and therefore the seeds should be planted *in situ*.

From the above description of this Indian tree, it seems to be possibly a desirable plant for introduction into other tropical countries.

THE OIL RESOURCES OF THE BRITISH EMPIRE.

By the courtesy of the Royal Society of Arts, there was reprinted in the June number of *Production*, an excerpt from a paper read before the Indian and Colonial Sections of the Royal Society of Arts, on June 4, 1920, by Prof. Sir John Cadman, K.C.M.G. D.Sc., etc., on the Oil Resources of the British Empire. From this the following observations and data are reproduced, as of general interest:—

The enormous, growth in the use of petroleum and petroleum products, stimulated in no small degree by the war, has led to a demand which at the moment threatens seriously to outstep the supply. Production, paralysed during the war by lack of material for field development, has not kept pace with the requirements, and in consequence there is a world shortage, with the natural result of famine prices, and an abnormal eagerness to explore new and untried fields

In order to focus this problem, it behoves me to picture to you in the first place what the world's resources of petroleum are, and from where they may be expected to come, both geogarphically and geologically; and then, if I can, to indicatee to you which are the likely new sources of supply, and how far these new sources fall within the boundaries of the Empire. It will be noted by reference to the map of the world that the continent of North America produces to-day over 85 per cent. of the world's output of crude oil. To this the United States at present produces in her own territory nearly 70 per cent. of the world's oil output, while, if the quantity produced by the United States in Mexico is added, the total United States control of North America is at least 80 per cent. of the world's oil supply. It will be seen, further, that the British Empire produces only about $2\frac{1}{2}$ per cent. of the world's supply, or, if Persia may be said to be under British influence, about $4\frac{1}{2}$ per cent of the whole.

Out of an immense proportion of the globe's surface covered by rock, likely to indicate the presence of petroleum, only an infinitesimal part has yet been thoroughly examined for petroleum products, and it must be some comfort to imagine that, even if only a moiety of them are found to contain petroleum, the stores of petroleum in the world are stil plentiful, and only await awakening by the geological hammer and the drill.

The figures for production are as follows:—

	Production, 1918 (Tons).
United Kingdom	250,000
Canada	40,000
Trinidad	300,000
India	1,150,000
Egypt	250,000
Australia, New Zealand, Sarawak	10,000
	80,000
Total British Empire	2,080,000
Persia	1,500,000
World's Production	70,000,000

UNITED KINGDOM—CONSUMPTION AND SOURCE OF SUPPLY.

The following figures approximately show the present consumption and source of supply for the United Kingdom, although in 1918 the consumption was on the basis of $5\frac{1}{2}$ million tons per annum:—

IMPORTS OF ALL PETROLEUM PRODUCTS TO THE UNITED KINGDOM.

Origin.	*Quantity. Tons.*
United States of America	1,800,000
Mexico	500,000
Dutch East Indies	120,000
British India	60,000
British West India Islands	130,000
Persia	90,000
Total	2,700,000

CONSUMPTION IN THE UNITED KINGDOM.

Products	*Quantity. Tons.*
Crude oil	30,000
Kerosene	620,000
M.T. Spirit	650,000
Lubricating oil	260,000
Gas oil	120,000
Fuel oil	1,020,000
Total	2,700,000

BRITISH EMPIRE—CONSUMPTION AND PRODUCTION.

The consumption and production of petroleum products in the British Empire have been approximately:—

	Consumption.	Production.
1912	4,212 000	1,421 000
1913	4,713,000	1,519,000
1914	5,467 000	1,563,000
1915	5,184 000	1,629,000
1916	6,128,000	1,655 000
1917	7,485,000	1,774,000
1918	9,038,000	2,078 000

1919.

	Consumption.	Production.
Great Britain	242,500	5,395,000
India	1,146,000	1,292 000
Canada	43,500	1,717,000
Australia	10,300	110,000
New Zealand	600	67 000
South Africa	—	54,000
Egypt	263,000	424,000
Trinidad	291,000	112,000

PROPAGATION OF SOME TROPICAL FRUITS

CULTIVATION OF THE PAPAW.

(*Concluded*)

Another method of reproducing trees of valuable types which has been resorted to, is that of grafting. Several methods have been tried, one of the simplest of which is shown in the accompanying illustration. The best results are obtained by using as stocks seedling plants in a very early stage of their development, when the stem is not larger than an ordinary lead pencil, and preferably less. Suitable material for scions is usually more difficult to get, but if, shortly before it is intended to carry out the operation, the selected trees which it is desired to propagate, are cut down so as to leave a stem of 4 or 5 feet in height and fertilized with ½ to 1lb. of nitrate of soda per tree, and well watered, they will produce a considerable number, sometimes as many as fifty, of young shoots. As soon as these reach the required size, and before they acquire a greater diameter than that of the stocks it is intended to graft them on, they are removed by means of a sharp knife, at the same time cutting off one-half to two-thirds of the leaves to prevent too rapid evaporation of moisture. The stocks on which it is intended to graft these should some time previously have been established in pots or cans, and be in a rapidly growing condition. These are cut off with a sharp budding knife several inches above the surface of the soil, and the stem carefully split downwards to the length of 1½ to 2½ inches, according to the size of the stocks and grafts used. One of the shoots previously removed from the parent tree is now cut wedge-shaped at its lower extremity, and fitted neatly into the incision in the stock.

Fig. 11. Method of Growing the Papaw Plant

A pin is then run through the stock and scion at the point of union, at right angles to the incision, to prevent slipping of the cut surfaces, and the union bound with soft string or raffia fibre, to hold the parts in place. The grafted plant ought to be set in the shade till the joints are well callussed, and growth of the scion started. When this has attained the height of about 18 inches, it is ready to transplant to its permanent position. Unfortunately this method of propagation, so successful with other fruit trees, has been found to be disappointing in the case of the papaw. It has been found after carrying the process through several generations that the vitality of the tree degenerates, resulting in the production of small and inferior fruits, unless the scions are continuously taken from seedling trees, in which case the process of grafting ceases to have any advantage over production by means of seed. Papaws may also be propagated from cuttings by removing the small side branches frequently found on the trunks of older trees, or by practising the method above indicated in connexion with grafting, but the cuttings must be fairly matured before removing. This process, however, has no practical value on a commercial scale, and is probably open to the same objections as noted above with grafting.

Papaws, when once well established, are of comparatively easy cultivation. They will grow and bear fruit on a variety of soils, but for the best results the land should be a fertile loam with plenty of organic matter. The roots are somewhat tender, and do not thrive well in hard soil. The seed, which should always be carefully selected, may be sown in a seed bed of fertile soil, and as soon as the young plants attain the height of about 2 inches they should be pricked off into pots, and kept in a rapidly growing condition till ready to be set out in the field. Plants removed directly from the seed bed to the field are apt to receive a severe check in growth, and the percentage of losses will probably be high. The papaw will respond well to good cultivation and manuring with either stable mauure or chemicals, preferably both To produce the best results the plantation should be made in a location well sheltered from the wind. The plants are tender, and easily broken by strong winds, while continued exposure to the drying action of a steady breeze results in reduced leaf surface, and an unthrifty condition, with small and inferior fruits. The trees will bear fruit in about a year from seed, sometimes less, the actual time depending on the conditions under which they are growing. While papaws will live and produce for three or more years under favourable conditions, as a rule the productive power of the trees decreases in quantity and quality. The increased height of the plants renders it difficult to pick the fruit, and the risk of damage from wind is so augmented, that it is advisable to replace older trees with young ones as soon as deterioration becomes evident.

Pruning of the papaw has been experimented with from time to time in the hope that the operation would result in increased productiveness, or change the sex of the male trees, or otherwise prove beneficial. The usual method pursued is to cut the top off the tree just before it reaches the flowering stage. This causes the production of several young shoots or branches, of which all but three or four of the strongest and

most vigorous are removed, and the tree allowed to develop a rounded head. After such an operation it has been found that the number of fruits is increased, but their average size is greatly reduced. Topping of trees in this manner is also sometimes resorted to as a means of regenerating old trees under special circumstances. Thinning of the fruits has also been experimented with at various times, and by different investigators. The general results of the trials indicate that removal of some of the fruits undoubtedly results in increased size of those remaining, but the increase in price obtainable for the smaller number of relatively larger fruits on trees so pruned, has not, as a rule, been sufficient to justify the practice. There are, however, indications that a moderate amount of thinning of the fruit where they are overcrowded to such an extent as seriously to interfere with their proper development, is profitable.

PREPARATION OF HIDES OF SHARKS FOR THE TANNER.

In view of a possible development of an industry in furnishing skins of the larger fish in West Indian waters to tanneries, the following information, furnished by the United States Bureau of Fisheries, will be found interesting and probably useful. It is intended to publish in a future number of the *Agricultural News* some suggestions as to the methods of capture of these large fish, which are recommended by various authorities.

Skinning sharks.—Remove all of the body fins, cutting them off as close to the body as possible without injuring the hide

Make an incision around the head, back of the mouth, and around the base of the tail.

Cut down the middle of the back from tail to head.

Remove the skin from the body carefully. Knife cuts, fork holes, or any other injury to the skin greatly lessens its value.

In skinning sharks, use a sharp butcher's knife, resharpening as fast as the edge is dulled.

Now stretch the hide on a curved or rounded beam-like surface, and dress the surplus meat from the hide, using a sharp butcher's knife for the purpose. If large quantities of skins are handled it will be best to provide a tanner's beam and a currier's knife for this work. It is important to remove as much flesh as possible without making cuts into the skin.

Salting.—The skins should be salted as soon as removed, while perfectly fresh.

Spread the fresh skins, outer side down, on a flat surface, and cover the entire flesh or raw side with a thin layer of salt, and rub it in. Be sure that the whole skin surface is thoroughly salted, especially the edges.

Fold in the sides of the skin even with gill slits along dotted lines as indicated in the figure, and roll the skin in a compact bundle.

After twenty-four hours, unroll, drain off water, resalt and roll again as before, leaving the skin for three or four days to season. It is then ready to ship.

Another method of salting the hides is to spread the skins on a slightly slanting surface, salting as before, and placing one skin on another in a pile (kench) to a height of 2 to 5 feet, each skin with the outer side down. They are placed on the slanting surface to permit the brine which forms to drain off. They should be resalted at the end of twenty-four hours, and cured for three to five days. In either case, before packing, shake off the surplus salt.

Boxing for shipment.—After the skins have been well cured, they should be rolled up as described above, and packed in a strong box or barrel of convenient size and weight for handling. Care should be exercised that there are no nail points on the inside of the containers, which may tear holes in the skins, thus reducing their value.

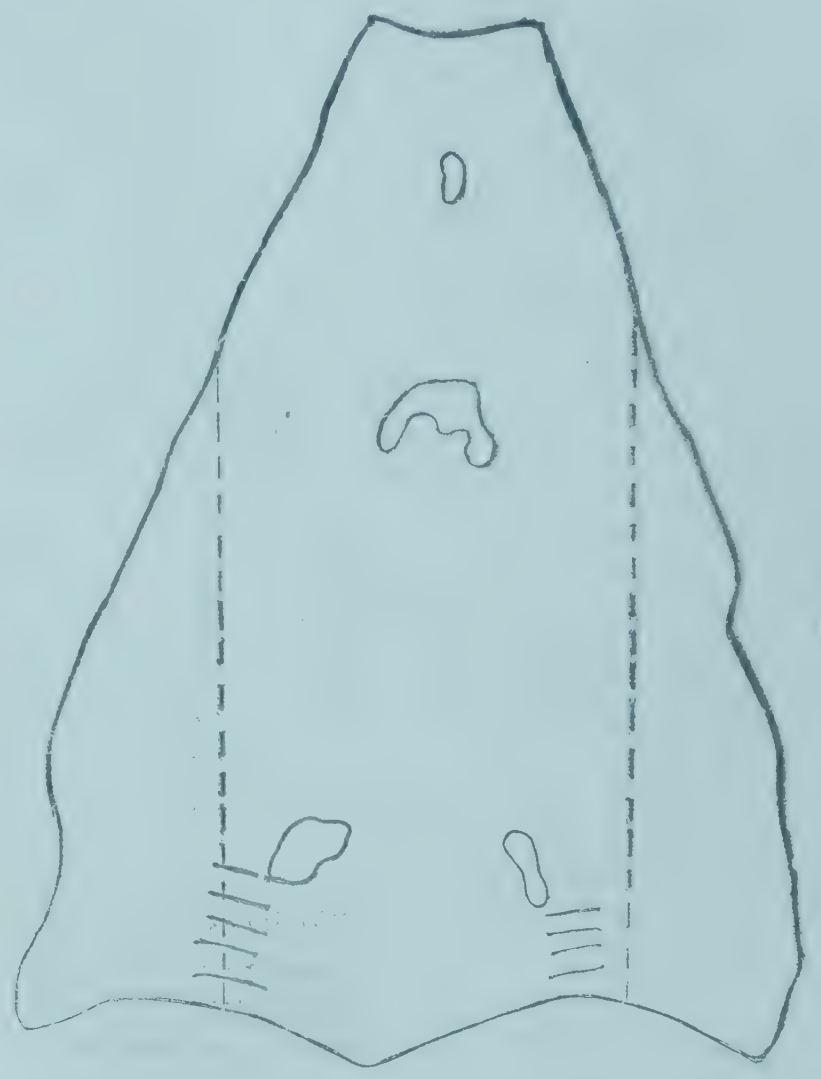

Fig. 12. Showing the manner of folding shark's skin *The dotted lines indicate the folds. The irregular lines mark the position of the holes caused by removal of fins. The transverse lines on each side indicate the gill slits.*

According to the 'Alaska (Juneau) Despatch' of September 20, 1916, one method of handling the skins of sharks cought in that region is to place them in brine tanks for eight days before they are dry-salted and baled for shipment.

Tanners of fish skins complain that many of the skins received are full of holes, making the product worthless. In many cases this is due to forking the fish It can not be too strongly emphasized that all possible care should be exercised by the fishermen to avoid making unnecessary cuts or holes in skins intended for manufacture into leather.

The importance of cutting down the *back*, and not down the belly, is to be emphasized, as in that way a larger expanse of skin is obtained free of holes, which necessarily are derived from taking off the fins.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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NOTES AND COMMENTS.

Contents of present issue.

The need of further research in the science of cultivation is the subject of the editorial.

Under Insect Notes, on page 266, will be found an article on bean weevils and a tiny enemy of theirs.

The article on the cultivation of the papaw, the first part of which appeared in the previous issue, is concluded on page 262.

An interesting article on cane farming in Trinided will be found on page 267.

Some useful recipes for the preparation of effective rat poisons are given on page 259.

Influence of Fermentation on the Starch Content of Corn Silage.

Although the results of fermentation in silage, with respect to acidity, alcohol, and sugar content have been reported on by former investigators, it would appear that no investigations concerning the starch content of corn silage have been recorded until the publication in the *Journal of Agricultural Research* May 15, 1920, of notes on experiments made by Messrs. Arthur W. Dox and Lester Yoder, Chemists at the Iowa Agricultural Experiment Station. A summary of the conclusions arrived at by the authors, which is given below, will probably be of interest at this time, when the question of silos and silage is attracting considerable attention.

The corn silage experimented with was tested at different stages of fermentation, and was found to be normals as regard development of aroma, and changes in acidity, alcohol, and sugar content. The experiments led to the following conclusions:—

(1) Changes in total acidity, alcohol, and sugar are entirely independent of the starch content of the corn placed in the silo, and of the silage produced from it.

(2) The first intermediate products resulting from the decomposition of starch are not present in demonstrable quantities.

(3) The starch content remained constant throughout the fermentation process.

(4) The starch granules remained intact, undergoing no physical change that can be detected by microscopic examination.

(5) Since starch constitutes about 10 per cent. of the corn plant at the time of placing in the silo, and represents over 400 calories of available energy per kilogram, the fact that no loss of this valuable material occurs during fermentation is an additional argument in favour of silage as an economical feed.

Fire Weed or Thorn Apple (*Datura Metel*).

Owing to war conditions there was experienced in the United Kingdom a shortage of plants from which various drugs are extracted. Among these were species of Datura which are the principal source from which the drugs scopolamine and hyoscyamine are obtained. These drugs are extracted from the leaves or the seeds of Datura.

In 1917 enquiry was made by the Imperial Institute, through the Imperial Department of Agriculture for the West Indies, whether it would be possible to obtain quantities of Datura leaves from any of the West Indian islands, where it was known that *Datura Metel* and related species were found commonly growing wild. As a result of this enquiry an experiment was made in 1918 in Montserrat, under the direction of the Curator of the Botanic Gardens, by a planter of that island, in growing the plant and drying its leaves for export. A bale of dried leaves was forwarded at the end of the year to the Imperial Institute for examination. According to the report

on the sample, it would appear that the leaves contained a satisfactory percentage of the alkaloids, yielding 0,578 per cent. of hyoscyamine, and 0,0542 of hyoscine, but that it would scarcely be worth while cultivating the plant under present prices for the material.

Last year a parcel of seeds was also forwarded from Montserrat to the Imperial Institute for examination. The report on these showed that they were not likely to be of commercial value, as the available material coming from India and Southern France contains a much higher percentage of alkaloids

The alkaloids from the West Indian seed proved to consist of hyoscyamine and scopolamine in the approximate production of 8 to 1, whereas in one of the samples of the Indian seed referred to above, the total alkaloids consisted of hyoscyamine and scopolamine in the ratio of 2 to 1, and in the other case, of scopolamine without any hyoscyamine. A small amount of atropine was also present in both Indian samples.

In *D. Metel* seed grown in France, Schmidt and Kirchner both found that the bulk of the alkaloid was scopolamine, accompanied by only small proportions of hyoscyamine and atropine.

This may of course be due to differences of environment; up to the present as the plant has not been cultivated in any sense in the West Indies. It does not, however, seem to be worth while attempting any such cultivation in these islands when other crops are more profitable.

The Green Lime Trade of Dominica.

The expected arrival at Dominica of the S.S. 'Lake Fife', of the Windward Islands Line, to take a trial shipment of green limes to Mobile, Alabama, was the subject of a note in the *Agricultural News*, May 29, 1920.

The steamer called at Roseau early in June, and left with 1,239 barrels of fruit, which, as shown by reports since received, were delivered in good condition.

Early in July the S.S. 'Lake Giltedge', of the same line, called and took the considerable shipment of 2,337 barrels and 747 boxes of fresh limes for the same destination.

On July 18 the 'Lake Fife' arrived from Mobile with sufficient material to make 20,000 standard boxes of 2 cubic feet each. On the basis of $4\frac{1}{2}$ cubic feet to the barrel, this number of boxes is equivalent to 8,888 barrels. It appears that the importing firm in Mobile is in favour of the use of standard boxes in place of the customary barrel, the latter being used generally in the trade in limes with New York.

The importation of so considerable a quantity of packages shows that the Mobile firm interested in this business is prepared to make a great effort to popularize Dominica limes in the Southern States. Given careful handling, and the present direct service by sea, it is felt that good results will be forthcoming.

This new development of trade with Mobile is opportune, as shipments of this fruit to New York have fallen off considerably of late. Opportunities of shipping to the latter port have been fewer than in previous years, but it is also evident that there is a lessened demand for limes in New York. This may be due to the effects of prohibition, as in former times green limes were used largely in alcoholic drinks. It is hoped that very soon the great value of the lime in 'soft' or non-alcoholic drinks will be recognized, and acted upon.

The Effects of Drought in Jamaica.

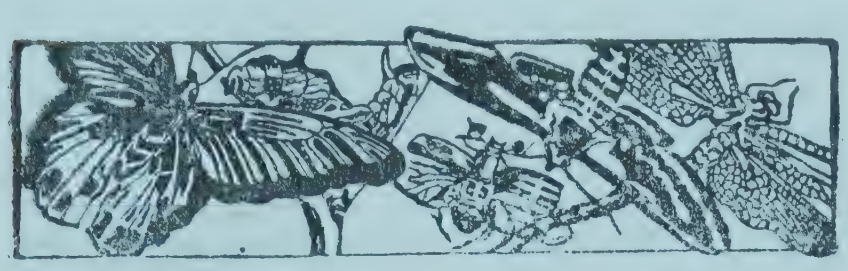
From all parts of the West Indies there have been continuous complaints of the disappointing weather conditions during the year, and of the probable crop shortage that is almost sure to ensue. According to the *Journal of the Jamaica Agricultural Society*, April and May 1920. the dry weather has given an especially heavy blow to the local production of food crops in the island.

Special efforts have been made in Jamaica towards a large extension of the area planted in local food crops, and it is stated that never for several years has more effort been made to plant such crops extensively than in the spring of this year. Food crops, especially corn and peas, were planted on a large scale by many proprietors who had never done so before, and, generally speaking, everyone who was in the habit of cultivating food crops planted still more.

Unfortunately the expected rains did not come, and the result has been that all crops have suffered very badly. In fact, most of the corn and peas, of which there was such extensive planting as with a good season would have made Jamaica independent of any importation of such articles, have been burned out. Taking the island all round, it is computed that 80 per cent. of all corn, peas, and beans planted from February to April will yield nothing. Yams, which appear to be the most important food crop in Jamaica next to corn, have experienced a severe set back; a large proportion of the plants have been also so burned out that they cannot revive. Sweet potatoes, it is expected, will spring again when rain comes, but the crop of this root will be late and poor, while slips for planting after rain will be very scarce.

'Station Agronomique' of Guade'oupe.

Under the editorship of the Director of the Station, Mr. J. S. Dash, B.S.A., the first number of a journal dealing with agricultural matters has recently been received at this Office. It contains much interesting and valuable information. Especially may be noted an article on fertilizers and the method of using them, evidently from the pen of the editor himself. From a short note it would appear that the work of raising new seedlings is being pushed on at the Station, with very promising results.



INSECT NOTES

A PREDACEOUS ENEMY OF BEAN WEEVILS.

The following description of the bean weevils found in the West Indies, together with the illustration, is taken from Ballou's 'Insect Pests of the Lesser Antilles'. It is stated that the pea and bean weevils, though commonly called weevils, are rather unlike the grain weevils, being broader in the body, with a short thick snout and prominent antennae. They belong to the genus Bruchus, of which there are several species, very much resembling each other in appearance, in habit, and in the plants they attack They are small insects, usually greyish in colour, with dark markings. The larvae are short, thick, almost legless grubs, which live and complete their development within the seeds of beans and peas

The female parent deposits eggs on, or in, the seed vessel of the food-plant, and the young larvae penetrate into the developing seeds.

These insects often cause much injury to stored peas, beans, and the like, which are intended for planting, by destroying the germinating power. The adults emerge later through a round hole in each seed that has been attacked.

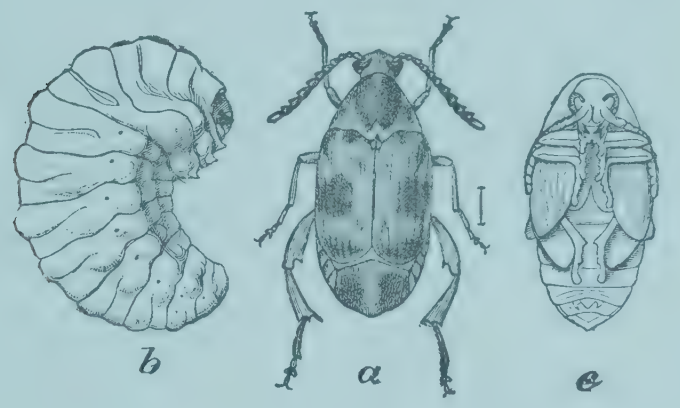


Fig. 13. Four-Spotted Bean Weevil.
(*Bruchus quadrimaculatas.*) (*a*) *beetle;* (*b*) *larva;* (*c*) *pupa. All much enlarged. From the U.S. Department of Agriculture.*

For the control of the pea and bean weevil, certain rules should be observed. It should be one rule to plant only uninfested seed, and another to destroy as far as possible the breeding places of the weevils during the time between crops of their food-plants When it is known or suspected that these insects have been abundant during the ripening of the crop in the field, the seed should be fumigated with carbon bisulphide soon after being harvested.

It might be, however, that a useful additional means of control, not referred to by Ballou, might be found in parasitic enemies such as is described below. It may be mentioned that the 'bête rouge' of these islands (*Trombidium* sp,) belongs to the family of mites; and the intolerable irritation of its bites is well known.

In the *Journal of Economic Entomology*, June 1920, an interesting note on a predaceous enemy of the bean weevil is published. The author, A. O. Larson, Scientific Assistant, Alhambra, California, writes amusingly. The following is quoted from his note:—

'While watching a bean weevil (*Bruchus quadrimaculatus*, Fabr.) ovipositing, in June 1919, the writer became convinced that there was something abnormal about its actions. After the weevil had deposited each of four eggs, it stroked its elytra with its hind legs; rapidly whipped its antennae back and forth; tried to bite its fore tibiae; extended its head as far as possible beneath its body; tried to roll over, and then extended its wings as if to fly; closed them up, and ran rapidly about, stopping frequently to scratch at its mouth. It tumbled about in the most excited manner. Examination showed a tiny mite attached to its labium.

'The abnormal movements were undoubtedbly efforts to rid itself of the intruder. At that time the weevil did not enlist the sympathies of the writer, but it rather gave him satisfaction to see how its enemies were after it. Later however, his sympathies were with the weevil because of the torture it was forced to bear.

'Although numerous eggs were deposited on the beans in the container, careful observations showed that only a few adult weevils emerged from them. Upon opening the beans several dead larvae and pupae were found, together with numerous round masses which proved to be gravid female mites. Several of the latter were put into a jar of black-eyed cowpeas from which many weevils were emerging. While the actions of the weevils showed that the mites were busy, several hundred eggs were desposited before the last one died

'When the dead weevils were removed from the jar, many were carrying gravid female mites protruding from their under wings. The following day the writer broke out with a case of "small-pox", this being the best description for the many pustules on his arms and body. Some days later, after again handling the mites, he experienced a recurrence of fiery, itching dermatitis. About that time a collaborator complained that he would have to get treatment for a terrible itch with which, he said, the "cooties" in the trenches in France were tame in comparison.

'The mites multiplied rapidly, killing some of the larvae and many of the pupae of the following generation of beetles, and the weevils that did emerge were immediately attacked by great numbers of mites, and were killed within a few hours. Vigorous, uninfested females of *B. quadrimaculatus* when placed in this jar were, in some instances, dead within two hours, and none were able to survive twenty-four hours. *B. obtectus*, Say, however, fared better when put into the same jar. They were able to rid themselves of the mites by using their mouth-parts as a comb through which they drew their legs and antennae, which were thus cleaned of mites, and these in turn were used for brushing their bodies. The mites were killed but not eaten. Of thirteen *B. obtectus*, five survived more than twenty-four hours.

'It was while examining the dead weevils inside the beans that the writer became well covered with those minute disseminators of intolerable fiery pustules. One hundred and eighteen pustules were scattered about on his person at one time, and it was then that his sympathies were with the weevils.

'According to Dr Erving, the mites are probably *Pediculoides ventricosus*, Newp

CANE FARMING IN TRINIDAD.

Mr. W. G. Freeman, B.Sc., Director of Agriculture, Trinidad, delivered a lecture to the Savana Grande District Agricultural Society of that island on June 24, 1920, the subject being 'The Cane Farming Industry; its Past, and Suggestions for its Future'. The lecture has since been published as a leaflet for circulation, and the following paragraphs are reproduced as of wide interest at the present moment, when the extension of the sugar-cane industry is of great importance.

It is an industry of the greatest importance to the prosperity of the colony at the present, when high prices are being obtained by both factory-owner and farmer, but while the future is far from clear, it seems to be an opportune moment to make a survey of the situation in the hope of leading to permanent improvements

The Trinidad cane-farming system was initiated by Sir Nevile Lubbock at the Usine St. Madeleine in 1882. In 1884, which was the first crop derived from the thirteen who had been induced to commence, the total was 2,242 tons. From this small beginning in Naparima the industry has progressed to such an extent that during the last four years (1916-19) the number of cane farmers in Trinidad has ranged from 20,402 to 22,226, with an average of 21,151.

In 1884 cane farmers produced an insignificant portion of the total crop: by 1899 they produced about one-fifth: by 1909 one-quarter: and during each of the years 1917, 1918, and 1919, a half, and in two of these three years slightly more than a half, of the colony's canes, i. e. the factories are supplied to day by cane farmers with approximately half the canes they grind.

Comparing 1919 with 1899 the estates cane production has decreased by about 90,000 tons and the farmers' has increased by about 160,000 tons.

The tendency is thus undoubtedly for the factories to to be increasingly dependent on the farmers for their cane supplies, a tendency which is likely to be still more marked, with shortage of labour. unless this can be compensated by increased mechanical tillage, or in other ways.

The cane farmers now produce half the crop; it is evident therefore that the success of the Colony's sugar industry depends on the efficiency of both the factory and the farmer. To secure the greatest efficency both should be mutually interested in the results of their work, sharing fortune good or bad.

A method of payment, practised in some of the West Indies, Mauritius, etc., is the market price during that crop of so many pounds of sugar per 100 lb. of cane According to the richness of the canes this varies from 4½ to 7 lb of sugar per 100 lb.

A modification of this, which formed the basis of the scale recommended by the Board of Agriculture in Trinidad after careful and prolonged consideration in 1916, was an equal division of the proceeds between buyer and seller, based on the f.o.b. price of grey crystals in Port-of-Spain. The scale allowed for the varying capacities of different factories, and would of course require to be drawn up each year. A first payment could be made on delivery of the canes, and the balance paid, after the crop had been sold, and the average f.o.b price, and also the number of tons of cane taken to make a ton of sugar ascertained. It was also recommended that there should be a minimum price to safeguard the farmer, and a maximum price in the interest of the estate, so that in the event of a bad year, the estate could afford to pay the minimum price on extra profits made in the good years There may be no necessity for minimum or maximum prices now. The scale was not adopted, but the estates made a first payment, and a deferred payment or 'bonus' at the end of the crop.

The Department of Agriculture in Trinidad grows some 1,200 to 1,500 tons of cane a year in its experiment and other plots, and having them to dispose of, is in the position of a cane farmer. For the last three years the canes were sold, after advertising for tenders, on the basis of a division of proceeds. Last year altogether $6·42 per ton, was realized. This year, selling to an estate which is securing the benefit of the high price of sugar, there is being received $12 as a first payment, and a further sum of one-half the profits, estimated at the time the contract was made at $2·96 per ton, but which will be more by the end of the year, owing to the subsequent rise in the price of sugar. This is a type of contract which is eminently fair, and having shared in the years of prosperity, it is reasonable to share in the years of adversity.

A notable advance since 1916 has been the sliding scales introduced by the Stc. Madeleine Company, and more general action on similar lines would go far to remove the danger of possible friction later, when affairs are not so prosperous for all concerned as they are now.

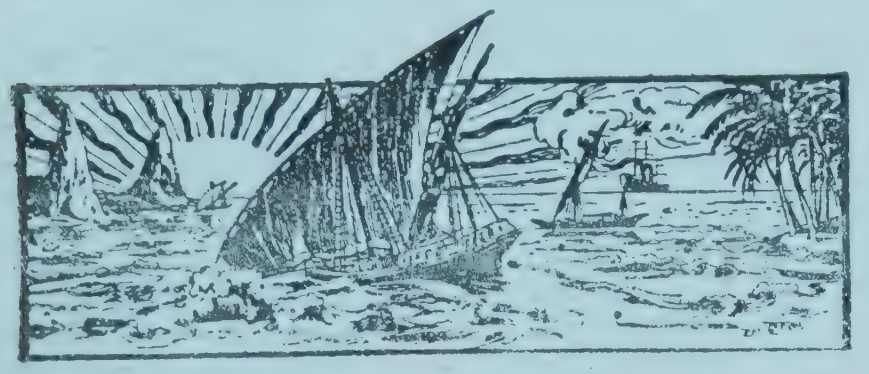
Cane farmers are either proprietors or tenants, the latter mainly annual tenants, usually undisturbed, but with no actual guarantee of continued possession. The former are safe, but the tenants are not in a good agricultural position. Farmers are advised, and good would result if they followed the advice, to practice rotation of crops, e.g ground provisions, beans, and peas, canes 1st, 2nd, and 3rd ratoons. For this, more than an annual tennancy is desirable. It may be suggested for consideration, the encouragement of men who can take up 10, 20, 50, or even 100 acres, on leases of say at least ten years, with option of renewal at an agreed figure. With larger holdings and greater security of tenure it would be possible to effect many improvements which are now impossible.

The farmer, given such a lease, should on his part agree to cultivate a definiate area of land in canes, and to sell them to the estate from which he holds the land, on a sliding scale based on division of proceeds or other agreed system. He should be encouraged to feel he is a partner in the estate, and directly interested in the results it obtains. If he grows more and better canes, both he and the estate will make more profit

The average cane farmer's yield per acre is notoriously low. There are exceptions, but the majority of farmers could almost certainly get half as much again. Instead of being content with 10 or 12 tons of cane to the acre, they should get 15 or 20. This can be done by better cultivation

Better tillage and a rotation of crops, with the great advantage of keeping part of the land in foodstuffs, are the most urgent necessities. As regards tillage, it will be wise to follow the example of the estates, and whenever possible make use of animal-drawn ploughs, hoes, and other implements. They are amongst the earliest agricuitural implements of the world, and yet some people rely on the fork, and the hoe. There will be the question of capital outlay. It may be practicable for the estate to assist on some modification of the share system to suit local conditions, or someone having animals might be able to under take the ploughing of land at so much an acre, using the animals for other work at other times of the year.

The world is calling for sugar. The West Indies are calling for labour. By improved organization, and better and more efficient methods, far better use can be made of the existing labour supply, and more sugar produced.



GLEANINGS.

On August 1 the Administrator of Dominica issued a Proclamation, prohibiting under severe penalties, the exportation of flour, bread, biscuits, arrowroot, ground provisions of all kinds, peas, beans, and farine, fruit, such as mangoes, avocados, plantains and banans, also onions and charcoal. (The *Dominica Chronicle* August 4, 1920.)

Para grass has proved a greater success in Hawaii than Guinea grass; it is found naturalized and grown for forage in several localities, making very luxuriant growth. Another grass which is said to have naturalized itself very successfully in certain parts of Hawaii, is the Natal or red top grass (*Tricholoena rosea*). (The *Philippine Agricultural Review* 1920.)

The *South African Sugar Journal*, May 1920, states that the British Royal Commission of Sugar Supplies has offered 90*s.* f.o.b., for 90 per cent of the total output of crystallized sugar in Mauritius, which means that the British Government Royal Commission is offering £90 per long ton for almost the whole of the Mauritius crop of first grade sugars. It is said, however, that the planters are asking for £100 per ton.

The *Nassau Tribune*, June 19, 1920, states that the canning factory wharves were then stacked high with 3,500 cases of pine-apples ready for shipment. The company had then sufficient pine apples on hand to keep the factory busy until further supplies were received. The company had also disposed of all the tomatoes canned by them last season. The quantity was altogether too small to supply the large demand, and it is hoped to increase the output to meet the trade.

Ground nuts are by far the most important agricultural product of Gambia. They are the colony's sole export of any importance, and therefore the source of its prosperity. The nuts are planted at the beginning of the rainy season in June and July; and are reaped in November after the rains are over. The Government is obliged to purchase for distribution to the native planters for seed purposes a certain quantity of the best of the crop (*Colonial Reports—Annual* No. 1034.)

The henna plant (*Lawsonia inermis*), which is commonly grown as a garden shrub in the West Indies because of the fragrance of its flowers, is widely cultivated in the countries of Northern Africa, according to a note in *L'Agronomie Coloniale*, March-April 1920, for the sake of its leaves, which are largely exported to France for the extraction of a dye chiefly used in the preparation of hair dyes in Paris. The inferior qualities of leaves are also utilized for tanning purposes.

According to a note in the *Philippine Agricultural Review*, 1920, the taro (*Colocasia esculenta*)—known in the West Indies as tannia, eddoe, dasheen—was formerly the staple food of the Hawaiians, and it is still an important food plant in Hawaii, where no less than 200 varieties are cultivated. Considering the value of this crop it is interesting to know that experiments have begun in Honolulu on the breeding of new taro varieties, and there are now under observation quite a number of seedlings. So far as is known, this is the first attempt on record in the breeding of taro.

In China the swine industry is, of animal industries, next in importance to that of raising poultry. It is difficult to ascertain the number of pigs raised there each year, and all estimates are little more than rough guesses. A conservative estimate of pigs raised annually in China would be 100,000,000. At the low price of $12 each, which is the average amount received for pigs sold on the market, the annual pig crop of China would thus have a value of $1,200,000,000. Most of the hogs exported are sent to Hong Kong and to Russia (The *Journal of Heredity*, March 1920.)

In the Caicos Islands a few men understand and practice a simple method of smoking fish. The fish is prepared as for dry salting, but only the surface moisture is dried off; the fish is then hung at the almost closed top of a smoke-box, about 4 feet by 4 feet square, and 6 feet high, for several days in a dense smoke produced from smouldering palm stems. Only sufficient air is admitted at the ground level to keep the smouldering wood alive. The flavour of the fish is said to be greatly improved, and it will keep for a few weeks. (The *Nassau Guardian*, June 2, 1920.)

The Times Jamaica correspondent in the issue of July 20, 1920, says that June witnessed a serious struggle between the four companies engaged in the banana trade in Jamaica. It was the biggest banana war the island has ever seen, and it was responsible for as much as 11*s.* 6*d.* a bunch being paid in the open market, while it is said that buying agents of some American concerns went to the length of paying the cost of transport to the shipping points—a very unusual practice. At the beginning of the fourth week of June the struggle began to abate. The price settled down in some parts of the island to from 5*s.* to 7*s* a bunch.

The Government Sugar Experiment Station on the Demerara East Coast was opened on June 19, by His Excellency the Governor of British Guiana. After inspecting the buildings, the Governor planted the first tops of seedling cane to be cultivated at the Station. After the ceremony, the Hon. J. B. Harrison, C.M.G. Director of Agriculture and Science, said that the occasion marked a point in the history of the colony which should be one of the greatest importance. It was one in which the planters of the colony had undertaken to support a very large Experiment Station for the purpose of improving their produce, and to study better methods of cultivation. Up to the present the greater part of the work of producing new and better canes had been done on a small field at the top of the Botanic Gardens. Of the present area in the colony under sugar-cane cultivation, 80 per cent. was planted in canes raised in that little field. (The *Demerara Agrosy*, Mail Edition, July 3, 1920.)

REPORT ON THE AGRICULTURAL DEPARTMENT, ST. KITTS-NEVIS, 1918-19.

Again, owing to difficulty in getting printing done quickly, this report has only just been issued. It contains, as usual, a large amount of interesting information concerning agricultural matters in the Presidency of St Kitts-Nevis.

From the Experiment Station large quantities of cuttings and seeds have been distributed during the year, especially cuttings of sweet potatoes, cassava, and sugar-cane; 2,800 lb. of specially selected cotton seed, together with a considerable quantity of peas and beans, Guinea corn, and peanuts were also distributed. Experiments in raising crops of economic value have been carried on as in previous years on plots at the Experiment Station at La Guérite.

The experiments conducted with cotton are of especial interest and importance. The manurial experiments, which have been conducted continuously for fifteen years, form a valuable record on this point. It is interesting to note that for the season under review the return of seed-cotton from the no-manure plot has greatly exceeded, except in the case of one plot, the return given by the manured plots in some instances exceeding 30 per cent. This result is very difficult to explain, but Mr. Shepherd, the Agricultural Superintendent, suggests that it is due to the production on the no manure plot of a larger number of flowers during the first flowering period, and also to a higher percentage of such flowers maturing into bolls. Another reason suggested is the severe attacks of the cotton stainer on the manured plots later in the flowering season, causing no return to be obtained from large numbers of bolls. The action of the manure seems also to have been masked to some extent by unfavouable weather conditions, as well as by the presence of the cotton stainer in unusual numbers. Tables are given showing the number of flowers produced during the first portion of the flowering period (July 9 to October 6), and the percentage of bolls obtained from these flowers, and also showing the number of flowers and the percentage of bolls produced during the whole flowering period (July 9 to November 30). From these tables it appears that the percentage of maturing bolls varied from 66·8 to 45·1 per cent. during the first part of the flowering period on the various plots.

The report contains instructive diagrams showing the flowering, bolling, and shedding curves on selected plots. The loss of such a considerable percentage of bolls is attributed not to water shortage entirely, although the shedding of young bolls, which commenced about the middle of August, may be put down to that cause, but a still greater loss is attributed by Mr. Shepherd to a sudden change in soil condition caused by a heavy fall of rain on September 10, after a long period of drought; the soil condition being thus rendered similar to that which was observed in former years as leading to the shedding of young bolls which takes place when hot days are followed by cool nights Careful seed selection is still carried on at the Experiment Station.

It may be noted that from the total area under cotton at the Experiment Station during the year reported on, which was 8 acres, a total return of 4,875 lb. of seed-cotton was obtained yielding 1,265 lb. lint. In this connexion it may be mentioned that, the supply of specially selected cotton seed being quite insufficiet for the needs of the Presidency, the Government have arranged to establish a Government Cotton Seed Farm at La Guérite consisting of 40 acres of land. Before leaving the subject of cotton it may be nonted that an Ordinance to make provision for the eradication of the pest known as the cotton stainer was passed on September 28, 1918. This Ordinance is on the lines of the one which has proved of so much benefit to the cotton industry in St. Vincent. It is hoped that Mr. Shepherd and the cotton growers of St. Kitts will soon, by the carrying cut of the provisions oft he Ordinance, cease to have to make complaints concerning the ravages of the cotton stainer. The estimated area planted in cotton in the three islands—St. Kitts Nevis, and Anguilla—was estimated at 5,800 acres. Although the return from some estates in the Northern district average from 200lb to 250lb. per acre, the estimated average return for the whole island was disappointing, as it would seem that 160lb. of lint per acre all round would be a fair estimate. The prices obtained for the cotton, which was all sold to the Imperial Government, were very satisfactory, ranging from 45*d.* to 40*d.* per lb. lint.

The export of sugar from the Presidency for the year 1918 was only 9,100 tons, of which 7,220 tons were crystals, and 1,880 tons muscovado. The low rainfall of the previous year was held responsible for this small crop, which was nearly 6,000 tons below that of the year 1917. Fortunately the high prices obtained for the sugar compensated in some measure for the shortage in the output. It is estimated that the average tonnage of cane per acre throughout the Presidency did not exceed 14 tons. Of the total area it seems that about 30 per cent. is planted with the White Transparent, 35 per cent. with B 147, and 35 per cent. with newer seedling varieties. Experiments with varieties of sugar-cane have been continued by the Department on different estates with the co-operation of the planters, but no manurial experiments with sugar cane could be undertaken during the year, owing to the impossibility of obtaining the required manures. It is hoped that a few of the best seedlings raised at Brighton estate will soon be ready for estate trials

In Nevis, at the Experiment Station, plot experiments with various economic and food producing crops continued to be satisfactorily carried on. One great advantage of this experimental cultivation is that large numbers of cuttings and seeds are available for distribution to growers of such crops as sweet potatoes, cassava, corn, peas and beans, yams, etc, throughout the island. No less than 251,000 cuttings of sweet potatoes, and 5,000 cuttings of cassava, together with 2,432lb. of selected cotton seed, and 5,935 cane plants were thus distributed. As in St. Kitts, experiments with varieties of sugar-cane were carried on at estates in conjunction with the officers of the Agricultural Department. Besides the large proportion of the cane crop which was sold to the Basseterre Factory, St. Kitts, muscovado sugar, chiefly for the local market, was manufactured on several estates.

The coco-nut plantation at Pinney's estate continues to do well, the total number of nuts reaped during the year having reached 189,448. It is to be noted that special attention was paid in Nevis during the year reported on to the growing of provision crops, under which a large arcreage was planted.

THE BRITISH COTTON-GROWING ASSOCIATION.

The following review of the annual report of the British Cotton Growing Association for the year 1919 is chiefly reproduced from the *Journal of the Royal Society of Arts*, July 23, 1920.

The report describes the work carried out by the Association in the development of cotton growing in India and the Colonies. It is hoped that the proposal in India to lease 7,500 acres in the Montgomery district of the Punjab Province, in order to demonstrate the possibilities of cultivating improved types of cotton, may be carried out in time for operations to begin in 1921.

In 1918-19 the crop of Sea Island cotton produced in the West Indian islands shows an increase on that of the previous year, which is doubtless due to the fact that planting was stimulated by the high price paid by His Majesty's Government for the cotton, which was all required for aeronautical purposes. For the twelve months ending September 30, 1919, the quantity of Sea Island cotton, exported from the West Indies amounted to 2,140,131, lb., as compared with 1,530, 109 lb. for the corresponding period of the previous year.

Substantial progress is being made in cotton growing in Rhodesia and South Africa, where the industry seems likely to become established on a permanent footing. Efforts are being made to improve the staple, and a prize scheme has been inaugurated to encourage planters to cultivate the best varieties on a more extensive scale.

The Sudan Government loan for £3,500,000 for development, including eailways, irrigation,, etc., was successfully issued during the year.

The possibilities of Mesopotamia are discussed, and it is stated that Experiments have established the fact that the country offers immense possibilities in cotton growing, the yield per acre in many cases being higher than is obtained in any other part of the world. The Council of the Association have decided to send out a ginning plant, and to begin direct operations without delay.

Recent political events in Mesopotamia will probably retard the realization of the hope expressed as to any considerable extension of cotton production in Mesopotamia.

The report adds that when the necessary extensions and improvements in transport facilities, ect., have been carried out in Nigeria, Uganda, Sudan, and Nyasaland, a steadily increasing quantity of cotton will be produced in those districts where it has been proved that cotton, eminently suitable for Lancashire spinners, can be grown on an extensive commencial scale. The importance of this is emphasized by the fact that not only does the growth of American consumption show the urgent necessity of extending cotton-growing areas in British territory, but the mills of the United States are taking larger and larger quantities of the Egyptian crop.

SHORTAGE OF FOODSTUFFS.

From all the West Indian islands there comes the complaint of shortage in imported foodstuffs, and of the inadequacy of locally-grown food crops to supply the shortage. Attention has been frequently directed to this question in previous issues of this Journal. It must be emphasized that this shortage of food is almost world-wide, and the position is not likely to improve for some time to come. Estate owners and peasant proprietors ought to pay attention to the question of planting provision crops, on a much increased scale

A circular recently issued by the Agricultural Department of St. Vincent, contains some sensible hints in this connexion which seem of more than local value. They are reproduced below :—

Don't be tempted to plant all your land in cotton. This is valuable, but cannot be eaten.

Don't plant all your land in sugar-cane. This is edible, but too much will cloy.

Don't forget to plant corn on every possible occasion. It forms a nutritious and well balanced food when a little meat is added.

Don't think that it is your neighbour's duty to plant provisions; it is yours as well as his.

Don't forget that it is sound policy to grow your own food

Don't forget that the value of money is decreasing, and the value of food increasing.

Don't be frightened of over production; a good market for ground provisions exists in neighbouring islands.

Don't forget to plant tannias and yams. It is not too late.

Don't neglect to plant sweet potatoes. The meal made from these is excellent.

Don't cut down breadfruit and other fruit trees when clearing land. They are a valuable source of food.

Don't forget that your island can almost be self-supporting as regards food. That is, if everybody helps.

Don't forget that it is the duty of all agriculturists in the island to grow sufficient foodcrops, and rear sufficient animals to supply local wants during the hard times which are undoubtedly ahead. Plant. Keep on planting and reaping.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. VINCENT. During the month of July the following plants were distributed: miscellaneous. 14; sweet potato cuttings, 2,800; cotton seed, 25½lb. Referring to staple crops, Mr. Jackson states that the growing cotton crop looks promising. Ginning operations at the Government Cotton Factory are practically over, but details as to the returns for the whole island for the past season are not yet to hand. During the month 63,114lb. of lint cotton were ginned at the factory. An embargo has been imposed on the exportation of provisions and certain animals from the island Ground provisions are still somewhat scarce; breadfruit are, however, now coming on the market. The appearance of cotton stainers, cotton worms, leaf-blister-mite, aphis, and pea chink in certain districts is recorded. The rainfall for the month at the Experiment Station, was 10·97; at the Botanic Garden, 13·07 inches.

DOMINICA. In the nurseries at the Experiment Station, 15,000 lime seedlings were transplanted in the month of July. Plant distribution comprised: limes, 11,600; cacao, 300; budded citrus, 107; nutmegs, 20; grafted mangoes, 10; miscellaneons, 8. In addition, 400 shade tree

cuttings and 286 packets vegetable seed were sold. The Curator, Mr. Joseph Jones, states in reference to food supplies, that the shortage of flour in the island during the past few weeks became so serious that a Proclamation was issued prohibiting absolutely the exportation of ground provisions and fruit. Syrup, which is largely consumed in the island, can now only be exported under Government license. The local price for limes dropped from 7*s.* 6*d.* to 6*s.* per barrel, and that of raw lime juice from 1*s.* to 9*d* per gallon. Concentrated lime juice is quoted at £45 in London. Planters are now busy with the lime crop, which, according to reports, gives promise of being a good one. Of the 1,922 seeds of camphor, received from the Imperial Commissioner of Agriculture, only 186 or 9·6 per cent. germinated. A meeting of the Permanent Exhibition Committee was held in the Court House, Roseau, on July 29, to consider a letter received from the Secretary of the West India Committee, inviting Dominica to take part in the forthcoming exhibitions to be held in London in 1921 and 1923, respectively. The decision reached was that Dominica should take part in both. After nearly four months of drought, rain fell during July in sufficient quantity to render the ground suitable for planting. The rainfall for the month equalled 12·08 inches. Owing to the increased cost of labour, the scale of charges for the plants mentioned below has been raised as follows: lime seedlings from 4*s.* to 5*s* per 100, budded citrus from 6*d.* to 1*s* each, and grafted mangoes from 2*s.* to 4*s.* each.

NEVIS. Mr. W. I. Howell, Agricultural Instructor, writes to say that the weather continued very dry during the month of July, and very little progress was made at the Botanic Station. Plant distribution included 5lb. cush yams and 5lb. Guinea corn. The cane crop throughout the island is suffering very much from want of rain; in some places the crops is almost beyond recovery. Very few fields have been established, and those that are growing have made very little progress. The cotton crop on the whole is very backward: a large portion of the crop is yet to be planted. In the New Road district the germination has been good, and the crop is looking promising. In other parts the crop is later than usual, and is suffering much from want of rain. The rainfall for the month was 1·79 inches; for the year to date, 13·05 inches.

BRITISH VIRGIN ISLANDS. The planting of approximately 5½ acres of cotton at the Botanic Station, Tortola, was completed during the month of July, but the whole cannot be said to be yet established, the Curator Mr. C. A. Gomez states, on account of the meagre rainfall. There is a small demand for limes in St Thomas, and approximately 6 barrels were reaped from the lime plots in the Experiment Station and sold to St. Thomas at $3·00 per barrel. The lime nursery has been extended, and the further transplanting of seedlings continued. The planting of onions from sets in the dry months of March and April has not been productive of good results. Onions planted from seed, however, are holding out better promise. The early planting of vegetables in Tortola is not to be recommended. The young cotton crop is doing better than might be expected under the weather conditions prevailing. In some districts—the East and North—cotton fields are making promising stands, but those in the South and West are in immediate need of rain. On the whole, the season so far cannot be said to be quite ideal for cotton; many growers are yet awaiting rain for planting. During the months of the planting season only 4·41 inches of rain have fallen. The demand for cotton seed has already reached the large amount of 2,000lb. Very hot days were experienced during the month, and the rainfall was scarcely enough to maintain vegetation in a luxuriant condition, the record being only 2·51 inches.

AGRICULTURE IN BARBADOS.

The rainfall for July was very favourable, particularly in highlands of St. John, St. Joseph, and St. Thomas, and in certain parts of St. Andrew.

The rainfall so far for the year is about 10 inches more than last year's. Some heavy rains are still needed to help the canes to continue their growth as rapidly as is desired, and in some localities they are still weak and suffering, particularly the ratoons in the black soils. In the red soils the canes are not yet up to their usual standard, except on a few estates where the weather was favourable, and the fields were well cultivated and manured.

The canes are still making progress, and should there be a rainfall in August similar to that of last year, they will still do well. There is however a threatened shortage in next year's production on many estates in St. Philip and other estates on the seaboard.

Supplying of the young crop is not yet completed, and where weather conditions permit, ratoons are still being 'stumped'. The ratoons have been very irregular and there has been great difficulty in getting good stools for this work. It is probable that the reason so many of the ratoons succumbed was that their ratooning power was weakened by the drought last year, and which continued this year.

Planters are going ahead rapidly with the cultivation of the young crops. It may be noticed that where the plough cannot be used, the land is broken with the fork, and cane holes are also dug with it. This work, well done, compares favourably with ploughed lands, and in some instances is better.

Field pens are being rapidly made. Pecking is also being done in some thin soils; this is useful work and should never be neglected. It cannot be over-emphasized that deeper and more frequent tillage is needed, with better manuring of the fields, to ensure good crops, and to protect the land from drought. Where fields have been well tilled and manured, the drought which existed last year has hardly any effect.

The yam and eddo fields continue to develop well. Manure is now being applied to these. Some fields of canes, and some open lands are becoming very grassy, and pond grass is once more growing rapidly in some places. With available labour and systematic farming of fields, grass can easily be eradicated. It should never be forgotten that one year's seeding means seven years weeding.

Several fields of 'nursery' canes may be seen growing well: it would, however, be a good thing if plants from first ratoons were given a fair trial next planting season.

Potatoes are still scarce, but it is hoped that the supply of them will soon be increased. Fields already planted are developing well. (The Barbados *Agricultural Reporter*, August 7, 1920.)

MARKET REPORTS.

London.—The West India Committee Circular June 10.

Balata—Venezuelan Block, no quotations; West Indian Sheet, 4*s.* 3½*d.* c.i.f., spot, 4*s.* 6½*d.* to 4*s.* 7*d.*
Beeswax—No quotations.
Cacao—Trinidad, 135*s.* to 140*s.*; Grenada, 100*s.* to 116*s.*; St. Lucia, and Dominica, no quotations; Jamaica, 115*s.*
Copra—£53.
Honey—75*s.* to 105*s.*
Lime Juice—Raw, No quotaions Concentrated, no quotations.
Pimento—5½*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castillos, no quotations.

Barbados—Messrs. T. S. Garraway & Co., August 18.

Arrowroot—$8·00 per 100 lb. duty paid.
Cacao—Lottings at 20c.
Coco-nuts—$52·00 husked nuts.
Hay—Sales at $6·00.
Onions—Lottings at $12·00.
Peas, Split—No quotations; Canada, $12·50 small, $15·00 large.
Potatoes—Market bare.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, June 22.

Bay Oil—30*s.* to 32*s.*
Lime Oil—7*s.* 6*d.* to 7*s.* 9*d.* for West Indian distilled, and for hand-pressed 27*s.* 6*d.* per lb.
Orange Oil—West Indian, 40*s.*

Trinidad.—Messrs. Gordon, Grant & Co., August 6.

Cacao—Venezuelan, $17·25 to $17·50.
Trinidad, $16·50 to $17·00.
Coco-nut Oil—$1·45 per gallon.
Coffee—Venezuelan, 20c. to 24c. per lb.
Copra—8c. per lb.
Dhal—No quotations.
Onions—5c. per lb.
Peas, Split—$11·00 per 100 lb.
Potatoes—English, 11c. per lb.
Rice—Yellow, $14·50 White, No. quotations.
Sugar—No quototions.

New York.—Messrs. Huth, Gillespie & Co., Inc. August 7.

Cacao—Caracas, 15½c. to 16c.; Grenada, 14c. to 15c.; Trinidad, 14¼c. to 14½c.; Jamaica, 11c. to 12c.
Coco-nuts—Jamaica selects, $52·00 per M; Trinidad $48·00 per M; Jamaica, $38·00; Trinidad $32·00 per M. culs
Copra—No quotations;
Coffee—Jamaica, 12½c. to 17c. per lb.
Ginger—35½c. to 39c. per lb.
Goat Skins—Jamaica. Antigua, Barbados, St. Thomas and St. Kitts 80c.
Grape Fruit—Jamaica, $3·00 to $5·00 per box.
Limes—$6·00 to $8.00 per bbl.
Mace—33c.
Nutmegs—21c.
Oranges—$5·00c.
Pimento—8¼c. per lb.
Sugar—Centrifugals, 96°, 15c.; Muscovados, 89°, 14c.; c. & f., Molasses, 89°, 13¾c.

Special Selected Sea Island Cotton Seed

— FOR —

PLANTING PURPOSES.

We can supply you with the above, selected from Seed grown at the Government Industrial Schools, and the Lunatic Asylum Farm, under the supervision of the Agricultural Department. Lint from this Seed has been highly reported on by the Spinners in England.

WE SOLICIT YOUR ORDERS.

The Barbados Co-operative Cotton Factory, Ltd.

WHITE PARK.
May 15, 1920.

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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

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Praedial Larceny.

THROUGHOUT the West Indies, including under this term the continental colonies of British Honduras and British Guiana, persistent and strenuous efforts have been made for the last four or five years by Agricultural Departments and Societies, with the hearty co-operation of the Governments of the various colonies, to induce a more extensive cultivation of food crops. These efforts have met with considerable success; it is probable that in the year 1919 more food crops have been produced in the West Indies than for many years previous.

There are, however, two factors which tend to prevent the full realization of what is hoped for and might be expected in this direction. The first is climatic conditions. Long periods of drought, at times of the year when rain is ordinarily expected, necessarily diminish the yield from fields planted in food crops. This is instanced in the conditions obtaining this year, when, after unprecedented efforts, in the earlier part of the year in planting food crops the unexpected, long-continued drought has led to a failure of the greatest portion of them. This weather factor is, of course, at present beyond human control, and, where irrigation is not possible, nothing can be done to eliminate its effect.

There is a second factor, however, tending to discourage efforts in the production of food crops, which does reasonably seem to be capable of control in civilized communities by organized action. This factor is 'praedial larceny,' as it is termed in the West Indies. In this article by this term is meant the robbery from the field of provision crops as distinct from crops grown for commercial purposes, such as cane, cacao, and limes, which are grown on a more extended scale.

This crime against society is unfortunately very wide-spread throughout the West Indies. From all the colonies there comes the complaint that, owing to the depredations of the 'praedial thief,' planters, whether on a large or a small scale, are discouraged from devoting any considerable proportion of their land to the cultivation of food crops. The hardship is especially felt by planters on a small scale. The owner of a large estate, who can put under corn or root crops very many acres, although he may grumble at the loss incurred at the hands of the praedial thief, does not suffer in proportion to the small cultivator, who having, perhaps, invested a large amount of his personal labour in the cultivation under food crops of an acre or so, sees all the results of his labour swept away in one night.

Naturally the question has received attention from the legislatures of the various colonies. Heavy penalties, comparatively speaking, consisting of fines or imprisonment are inflicted on offenders convicted of praedial larceny; in some colonies, as in Barbados for instance, the convicted offender may be sentenced by the magistrate to a flogging, in addition to a term of imprisonment with hard labour. Up to the present however, in spite of what might be supposed to be deterrents in the shape of these legal penalties, the crime of praedial larceny does not appear to be on the decrease.

As was stated above, it would seem that it ought to be possible for the social body to eliminate this factor of crime, which militates against any one of the West Indian colonies becoming self-supporting in the matter of foodstuffs. The fact is that under present legislative enactments the punishment, even though apparently severe, does not fit the crime, nor does such a punishment tend to the amendment of the life of the wrong-doer, or to the turning of an idle rogue into an honest worker. Praedial thieves are usually found among the idle vagabonds of a community, who do no honest work at all, and simply look out for a chance of feeding themselves at their neighbour's expense. From such individuals no fine can be extracted, and the alternative of a short term of imprisonment, even with a flogging added, has no terrors for them. In gaol they are probably better fed, clothed, and housed than they are outside. The hard labour in gaol is monotonous and unproductive; accordingly, in few instances does there appear any amendment; on the contrary, such offenders periodically appear before the magistrate, and are sentenced for the same crime over and over again.

Yet it would seem that there could be found some punishment for praedial larceny which would be at once deterrent with regard to the offence, and possibly remedial for the offender. Some such idea at least seems to be in the minds of members of the Government in Jamaica. There is at present a Bill before the Legislative Council of that island, dealing with this question. On June 16, the Acting Attorney General moved a second reading of a Bill, entitled a law further to amend the laws relating to praedial larceny.

According to the Jamaica *Daily Gleaner* of June 17, the Acting Attorney General pointed out that the proposed law primarily provided for persons convicted of praedial larceny being placed on a land settlement to be established by the Government. The idea was to endeavour to reform persons who had been convicted of the crime.

It appears to be the intention that all such criminals shall be put to remunerative and useful work, of course under strict supervision and regulation, on such Government farm or land settlement, and that all amounts earned by their labour shall be credited to them individually. The intention seems to be that the first charge on this amount earned by each individual offender is the value legally assessed of the produce stolen from his neighbour's field, and that the sentence will be an indeterminate one, until such payment can be made

The Bill has not yet been passed, but has been deferred, under consideration in Committee, until the next Session.

The question of an indeterminate sentence will perhaps not meet with general approval. Such indeterminate sentences, however, are in force, to meet certain cases of crime, in some of the United States of America, it is stated with good results. Considering the objects proposed in this Bill, one can hardly help thinking that the indeterminate character of the sentence must be vital to its success.

Punishment, such as outlined above, looks as if it fitted the offence better than the ordinary rough and ready methods of chastisement. In the first place, if the praedial thief knows that he will have to work usefully, until the amount of damage he has inflicted on his neighbour is really restored, he will probably be much deterred from inflicting such damage. In the second place, agricultural labour on such a Government farm, with strict supervision and instruction, ought to go far in teaching an idle vagabond industrious and honest habits.

Jamaica is in a particularly favourable position for making such an experiment as has been outlined above, seeing that there is a large quantity of crown land in various parts of the island, available for the purpose of the institution of a government farm, with the object of reclaiming praedial thieves. Should the Bill be passed by the Jamaica Legislative Council the results of the experiment will be followed with great interest by other colonies of these islands. It is true that in most of them there are already reformatories for the purpose of teaching young criminals habits of industry. The point of the Jamaica idea is, however, somewhat different, as will be noted from

what has been said above. It is not only reformatory in its scope, but will be, it is hoped, also deterrent because of the restitution enforced, which is a principal feature of the scheme; and it would deal with older offenders.

Hardly any one of the West Indian colonies is without the possibility of maintaining a Government farm for the same purpose as that proposed in Jamaica. Of course, in any case the necessary legal enactments would have to be passed. It might be advisable in this connexion to make careful and wise amendments, not only in the laws relating to praedial larceny, but in those relating to the treatment of vagrants, the class from which, as has been emphasized above, praedial thieves are chiefly recruited. It is hoped that these questions here raised may have careful and wide consideration.

INDUSTRIAL DEVELOPMENT IN JAMAICA.

The Jamaica *Gleaner*, July 29, 1920, reports in full the proceedings at a meeting held in the Town of Mandeville, when the schemes proposed to be carried out on the large stock pen, 'Grove Place', lately purchased by the Government, were outlined by the Director of Agriculture, the Hon. H H. Cousins.

The first industry that Mr. Cousins referred to as capable of considerable development was the fibre industry. He referred to the success which had been attained in the cultivation of sisal on the dry savannah lands of the Government Farm at Lititz. It had been now demonstrated, he said, that an acre of sisal could be grown for an expenditure of £4, and that a first yield of half a ton of fibre could be obtained, worth £28 at present. The funds for erecting a fibre factory capable of producing 500 tons of fibre per annum, had been provided. The factory was to be a co operative one, and would buy leaves from planters who grew sisal on the lands adjoining Lititz. Sisal was a crop which was eminently suited to withstand drought conditions, and could be grown almost anywhere, except on swamp lands. The development of this industry seemed to offer great possibilities.

The next industry capable of development in Jamaica was, Mr. Cousins said, that of condensed milk. He wondered why the island should be content to pay from £30,000 to £50,000 per annum for imported condensed milk, when it could all be produced locally. The point was that an island condensed milk industry should be organized, and then condensed milk could be produced and sold for local consumption much cheaper than the imported product. There were difficulties to be faced in establishing a successful tropical dairying industry, but pioneer work had been already done, and it was proposed to test out thoroughly the conditions for the successful handling and transport of milk by rail in Jamaica. The production of a refined syrup with ordinary brown sugar for making condensed milk was also being investigated. They would require a better class of dairy cattle, for the feeding of which fodder crops must be grown, such as maize, guinea corn, and sugar-cane for fodder; silos also ought to be erected. The chief enemy of the dairy industry in the parish of Manchester was the cattle tick. There had been a great improvement in this matter by spraying with insecticides. At Grove Place a dipping tank had been erected; it was a public dipping tank, and any cattle could be dipped there at the rate of one penny per head It was to be hoped, therefore, that before long the whole parish would be rendered tick free.

The next point to which Mr. Cousins referred was the development of a pimento oil industry. As is well known, the pimento tree (*Pimenta officinalis*), which grows wild in Jamaica, is the source of the commercial product 'allspice' derived from the berries. The leaves of the tree, like another species of the same genus (*P. acris*), from which is obtained the fragrant bay oil of the Lesser Antilles, possess a spicy scent when fresh. Attempts to obtain a similar product to bay oil, by distillation of the Jamaica pimento leaves, have not been successful. However, samples of dry pimento leaves were forwarded to the Imperial Institute for examination, and a report was received showing that the dried leaves contained 2·9 per cent. of essential oil, containing 89 per cent. of 'eugenol.' Now, this eugenol is of considerable value, and is the basis for the synthetic manufacture of 'vanillin.' Vanillin is now selling at about 80*s.* per lb., and the demand for this flavouring substance was increasing, especially in 'dry' America The Industrial Chemist of the Agricultural Department had recently made an important discovery, namely, that by the fermentation of the pimento leaves the oil spontaneously changed to 'isoeugenol,' the half-way product in the preparation of vanillin. In other words, it was possible, either in the field, or perhaps in a silo, by natural fermentation of the leaves, to effect a chemical change at a great saving of time and money when compared with chemical means in a factory.

Mr Cousins considered that in view of these facts Jamaica might shortly be in control of the vanillin market of the world from the yield of leaves of the wild pimento as a source of this product. He advocated the establishment of a vanillin co-operative factory at Grove Place, where leaves would be bought, and where to every seller a receipt would be given, which would entitle the holder to a bonus at the end of the crop from the profits. Pimento oil would also be bought from larger growers distilling their own oil, and this could be converted into vanillin, also on profit-sharing lines. As far as possible, he considered that the profits of the vanillin industry should go to the growers of the pimento leaves.

Another devlopment which Mr Cousins hoped that the Government Farm at Grove Place would effect was by the establishment of a stud farm there, by means of which the breeds of animals would be greatly improved, if advantage was taken by keepers of stock of the opportunities thus afforded. Especially did he refer to the improvement possible in the cattle of the island, which had been demonstrated by the work at the Government Farm of 'Hope'. The value of good cattle is going up all over the world, and Mr Cousins considered that Jamaica might easily become the great stud farm of the Caribbean.

It is evident from the foregoing that Jamaicans are not only going ahead in the development of their standard industries, sugar and bananas, but that they are fully awake to the possibilities attaching to other industries, and that they intend to avoid the mistake, which has often led to disaster in many of these West Indian islands, of putting all of their eggs into one basket.

AGRICULTURAL CREDIT SOCIETIES IN TRINIDAD.

The Trinidad *Guardian*, August 8, 1920, contains a full report of a joint meeting of the Agricultural Societies of the Ste. Madeleine group of estates, held the day before at the Ste. Madeleine Usine, when His Excellency the Acting Governor took the chair.

The successful working of these Societies was brought out very clearly in the report presented by Mr. G A. Jones, the Hon. Secretary of this group of Credit Societies, which are in number sixteen registered, with a total membership of 1,113, while four new Societies are now awaiting registration.

The following paragraphs, reproduced from Mr. Jones's report, show most clearly the advance which is being made in this direction, and the evident stability of the position of the Societies referred to:—

On July 1, 1920, the members had outstanding balances amounting to $10,670·94, and the Societies owed the Colonial Bank $8,415·94: this will be repaid during 1921.

The Colonial Bank charged the Societies as interest $3,021·30, and the Societies charged its members $5,891·24. The cost of administration worked out at $399.32, or in other words, per Society $27, per member 3½ cents.

This compares very favourably with $1·20 per member for similar expenses in running some 12,000 societies in Germany in 1910.

When considering the cost of administration, the Societies must not forget that they have in the Ste. Madeleine Sugar Co., Ltd., a very kind and considerate foster-parent.

When once firmly established the cost of administration will probably be higher.

The net profit on the year's working amounted to $2,224 05. The reserve fund amounts to $1819·58; so that the Societies, on a year's working, have cash to their credit amounting to $4,043.63.

The financial aim of each Society is to build up a sufficient reserve fund so as to serve as cover for any possible future losses. Profits cannot be shared amongst the members.

Of the 1,113 members loans were granted to 785, so that the average amount given out per borrowing member amounted to $83, the highest loan was for $2,000 which was repaid in full: there was one loan for $,1000 also repaid in full. There were several loans for sums between $500 and $1,000 but the large majority of the loans were for sums of between $50 and $200.

The purposes for which the loans have been granted have been analysed, and are as follows:—

$34,931, or 53·6 per cent. of the amount, was given out for cane cultivation.

$13,692, or 21 per cent. was given out for the purchase of animals

$5,333: or 8·1 per cent. was given out for repairs to old, and erection of new houses.

$2,055, or 32 per cent. was given out for purchase of land, mainly house spots.

$9,114, or 14 per cent. was given out for miscellaneous purposes: rice cultivation, vegetable cultivation, paying debts, etc.

The security offered for the loans to the Colonial Bank, namely the unlimited liability of all the members, is ample. The security offered by the members of the Society is mainly personal, backed by such property as a member may possess, the amount given to each member depending upon the security offered.

The organisation of the Societies is well known. Each Society is worked by the members appointing a committee, two trustees, a secretary, a treasurer. and two auditors; each of the sixteen Societies have all these officers.

Mr. W. G. Freeman, Director of Agriculture, and Registrar of Agricultural Credit Societies, also addressed the meeting, and stated that at present there were twenty four registered Credit Societies in Trinidad, and six in Tobago, and that the growth of the movement was very encouraging.

Mr. Freeman also pointed out that the success of credit societies was not indicated by how much money they have lent, but by ascertaining whether that money had been put to good use, and repaid when due. He thoroughly believed that, on the whole, the money lent had been put to good use, and had been promptly repaid when due.

After some speeches by gentlemen interested in the movement, the, Governor congratulated the Societies on their good position, and the meeting then closed.

FUEL FOR MOTOR TRANSPORT.

The Department of Scientific and Industrial Research established in 1919 a small permanent organisation of the Fuel Research Board, to investigate problems connected with the practical development of the production and utilization of power alcohol. The Fuel Research Board has recently issued an interim memorandum on the question of fuel for motor transport. From this report the following paragraphs are chiefly taken.

The scarcity and dearness of motor fuel has aroused public interest in the question of future supplies, and considerable uneasiness has been expressed as to the prospect for the future. In the minds of many students of the subject, the part which alcohol might play, as a substitute for petrol as a motor fuel, has bulked very largely; and the view has been expressed that power alcohol will be the motor fuel of the future. It has in some cases been assumed that the only barrier to this replacement is the indifference or lethargy of the Goverment Departments which control the importation and use of alcohol. The difficulties to be faced are, however, of a more fundamental character, being chiefly due to the absence of sufficient supplies of raw material, and the excessive cost of such materials as are available.

The main sources of alcohol are vegetable materials containing starch or sugar, and practically all the alcohol for potable and industrial purposes is now made from grain or molasses.

It may be stated generally that the production of alcohol in any considerable quantities from vegetable material grown in the United Kingdom is not economically possible, owing to— (1) insufficient acreage,(2) the high cost of cultivation and harvesting,(3) the high cost of manufacture, and (4) that the most suitable raw materials are also important foodstuffs. There is for these reasons no prospect of replacing any quantity of petrol by home-produced alcohol.

Considering the possible production in the Empire outside the United Kingdom, molasses is the raw material which can be converted into alcohol most cheaply. Molasses is a by-product of sugar making, and the quantities available for the manufacture of alcohol are therefore dependent on the sugar output. Considerable quantities of molasses are already used in the United Kingdom

for the manufacture of industrial spirit, but, as a commercial proposition, it would be better probably to convert the molasses into alcohol where it is produced, to use the alcohol where it is made to supplement or replace petrol, and to export the balance. With the present increasing output of cane sugar there should be very considerable quantities of molasses available for the manufacture of power alcohol.

All matters in connexion with the question of the Empire production of power alcohol are being investigated. The report even suggests that the cultivation of plants other than sugar-cane, containing starch or sugar, for the special purpose of using them as the raw materials for the manufacture of power alcohol, may be possible. It is pointed out, however, that even in the event of it being possible to produce such alcohol within the Empire, at a price at which it could be imported and sold profitably in the United Kingdom, it must be a matter of time before supplies in any great quantities could be available.

From the report it appears that the Finance Bill for this Session of Parliament will have a section dealing with the question of excise duty on denatured spirits, the result of which will be that the production and use of alcohol for power purposes will be much facilitated, and the expense connected with any necessary restrictions will largely disappear.

Under existing conditions the report considers, however, that coal is likely to remain the most important source of heat and power, especially as the possibilities of coal in this direction are not limited to its use in the raw state as it comes up from the mines. By processes of carbonization and gasification raw coal can be 'sorted out' into gaseous, liquid, and solid fuels, and a large percentage of the potential thermal units which it contains can be obtained in forms which are more available for the production of heat and power than are the thermal units of the raw coal.

THE DWARF BAMBOO AS A PAPER-MAKING MATERIAL.

In an article which appeared in the *Journal of the Royal Society of Arts* August 20, 1920, it is stated that the Philippine Islands produce an abundance of fibres and other raw materials suitable for the manufacture of paper. There are also in these islands plenty of the raw materials required for the manufacture of the chemicals used in paper making. As far as is known, no paper has ever been made in the Philippines, except for experimental purposes, and at present none of the above mentioned raw materials are being utilized for this purpose.

Experiments were made by the Philippine Bureau of Science, with the object of determining the commercial availability, for paper-making, of the fibres from members of the plantain family, of certain palms, bamboos, grasses, and certain woods.

It is stated in the article referred to above that of all the materials for the manufacture of paper found in the Philippines, the bamboos are the most important, considered from every point of veiw. Not only is the paper made from bamboo of excellent quality, but a constant, adequate, and accessible supply of this material could be available for a paper or pulp factory, more readily than such a supply of any other material

Experiments were made with the two most important aud widely-distributed bamboos; the common, thick-walled variety (*Bambusa blumeana*), commonly employed for building purposes throughout the islands, and the thin-walled, dwarf bamboo, used in the Philippines for the manufacture of woven products for furnishing the interiors of nipa houses, and for other purposes.

The thick-walled variety is grown as a crop along the river bottoms and other sections of the islands, from cuttings, set out in rows from 60 to 90 cm. apart, and marketable culmns are produced in from one to two years

The thin-walled variety, also known by the name of 'cano bojo', is found almost entirely within the forested regions of the country, and is a veritable forest pest. It is never cultivated, but is cut without restraint to prevent its deleterious effect on forest growth.

The following important facts, in respect to bamboo as a paper-making material, developed from experiments made some years ago by Mr. G. F. Richmond, for several years attached to the Chemical Laboratory of the Philippine Bureau of Science :—

(1) The dwarf bamboo is better than the variety used for building purposes, in that it yields more unbleached pulp, and requires less of the bleaching agent to give the best results. The structural bamboo requires from 20 to 25 per cent. of bleach to give but poor results, but a satisfactory white is obtained from dwarf bamboo with from 10 to 20 per cent. of bleach. This, it is mentioned, compares well with the results obtained from straws of various kinds.

(2) A well digested pulp is obtained from bamboo by use of from 10 to 20 per cent. of caustic soda, calculated on the gross weight of the stems.

(3) The time required for digestion, the pressure, and the temperature employed are materially less than those required in making pulp from soft woods by the same process. In fact, in these particulars, bamboo compares favourably with straw and similar materials.

(4) Both the sulphite and soda process may be employed in working up 'cano bojo.' By the former process, fully 50 per cent. of unbleached pulp may be obtained, and that with the use of much less sulphur than is necessary for the making of wood pulp. By the latter process 43 to 45 per cent. of air-dry, unbleached soda-pulp is obtained. The use of caustic soda is recommended for bamboo, because of certain difficulties to be overcome in the use of the sulphite process. The results described were obtained by the use of caustic soda under the following coditions:—

(a) Upright cylindrical stationary digesters; (b) direct live-steam heat; (c) 15 to 20 per cent. of 76 per cent. caustic soda, calculated on the air-dry weight of the raw material; (d) a duration of cooking of from four to six hours; (e) a maximum temperature of 160°C. (320°F.) corresponding to a steam pressure of 45 Kilos.

(5) Pulp obtained by the sulphite process is not light enough in colour to be mixed with mechanical wood pulp in the manufacture of news-print paper. It is entirely suited in point of colour for use as a wrapping paper, but it is too valuable, by reason of its fibre, to be used for wrapping paper or the making of newspaper stocks. The strength of bamboo fibre makes it especially adapted to the manufacture of book paper, and certain grades of writing and lithographic papers. For these purposes it may be used alone or mixed with rag or sulphite wood pulp.

(6) If the bamboo pulp is to be used in the making of book and lithographic papers, the soda process should be employed in its manufacture, because bulk, softness and opacity are the chief features of soda pulp. This pulp bleaches to an excellent white with from 12 to 15 per cent. of bleaching powder. The resulting sheet is more bulky than that from wood pulp, and possesses a strong fibre, 2·5 to 3 mm. in length—longer and narrower than spruce fibres—and a good felting capacity.

THE COLOURING MATTERS IN CANE-JUICES AND SYRUPS.

An article by Dr. F. W. Zerban of the Louisiana Sugar Experiment Station, New Orleans, published in the *Louisiana Planter*, August 14, 1920, gives an interesting survey of the results of investigations carried out in his laboratory on the relative importance of some of the colouring matters in cane juices and sugar-house products.

The colour of raw cane juice has been shown to be due to three chief factors; tannin, iron salts, and oxidases. The latter are colloidal enzymes which greatly accelerate the rate of oxidation by free (molecular) oxygen, of certain substances contained in animal and plant tissues. Cane juice turns brown when exposed to air, because of the rapid oxidation of certain complex organic compounds known as tannins occuring normally in it. This rapid oxidation, due to the contact of the expressed juice with the air, is produced by the presence of oxidases in the juice.

Further, iron salts react with tannins to form compounds of a dark green colour, so that if iron salts gain access to raw cane juice, as is possible when the juice is extracted by iron rollers, the juice may exhibit any shade of colour between brown and dark green.

To the three chief factors responsible for the colour of raw cane juice, several others may be added. One of these is present in the fibre of the cane, and is a yellow substance known as saccharetin. If the straining of the juice is in any way faulty, particles of megass escaping into it may have the saccharetin in their fibres extracted when the juice is heated.

Another colouring matter which is present to a greater or lesser degree in raw cane juice is the natural colouring matter of the rind of fresh canes. Its colour and intensity depend partly on the variety of the cane, for purple and red canes contain a greater amount of it than do green or yellow canes. Rind colouring matters belong to the class of compounds known as anthocyans, to which many of the substances that impart bright colours to flowers and to autumn-tinted leaves belong.

It is interesting to note that tannins, saccharetin, and anthocyans are all chemically related, and that for this reason they are frequently referred to collectively as polyphenols.

The green substance chlorophyll, which plays such an important part in green plants in connexion with the photosynthesis of carbobydrates from carbonic oxide and water, is of relatively small importance as a colouring matter of raw cane juice, since it is insoluble in cane juice.

The colour of boiling-house products such as syrup, massecuite, molasses, and manufactured sugar, as distinct from raw cane juice, is due in part to the polyphenol colouring matters of raw cane juice, and also in part to the products formed by the decomposition of sugars under the influence of heat alone, or by the effect of lime or other alkali at a high temperature. The formation of secondary colouring matters by the combined effect of heat and alkalies on sugars is greatly accelerated by the presence of certain amino-acids which are of common occurrence in boiled cane juice. Such amino acids result from the hydrolysis of proteins in the juice subsequent to extraction.

The classes of colouring matters whose main features have been outlined have long been known, but little is yet understood as to the exact extent to which each of them contributes to the colour of any one product of the sugar house. It is a matter of great importance, however, that exact knowledge of such a nature should be obtained, for it governs the proceedure in any one factory where the manufacture of a certain type of final product is desired.

To illustrate this point, the author of the article under review instances the needs of Javan sugar manufacturers as contrasted with those of the technologists of the Louisiana factories. Javan factories are striving to produce a high grade white sugar, the quality of the final molasses being immaterial, whereas the factories in Louisiana have to produce white sugar along with pale-coloured syrups and molasses to satisfy the demands of the present day consumer in the United States. To obtain the Javan products, the 'acid-thin-juice' process with heavy sulphitation of the syrup gives very satisfactory results, for it apparently prevents the iron salts present in the massecuite from entering the sugar crystals It, results, however, in a molasses quite unfit for human consumption. In order to obtain pale coloured molasses as well as white sugar, which is the aim of the Louisiana manufacturer, the research now to be described seems to lead to the conclusion that the presence of iron in both the massecuite and the final sugar must be altogether prevented.

It was with a view to solving the problem which faced the Louisiana sugar manufacturers that an investigation aiming at the elucidation of the nature of the various factors which contribute to the colour of the products of sugar manufacture in Louisiana factories, and of the proportion in which these are present, was undertaken by Dr. Zerban. The major part of his article is devoted to a description of the methods used, and to a discussion of the conclusions drawn from his results The object of the first part of the research was to examine the effect of two groups of colouring matters on the colour of the syrup. The colour of the denser products of massecuite and crystal sugar is to be investigated later. The two factors examined were the colouring matters produced by decomposition of sugars by heat, and the green, iron tannin compounds. The methods used was a synthetic method. Artificial raw juices were made up to the following specifications.

First series. A solution containing 12 per cent of sucrose plus a sufficient amount of aconitic acid, the principal acid of the sugar cane, to make the juice of average acidity.

Second series. A solution similar in composition to the last but with the addition of 2·1 per cent. of invert sugar.

Third series. As in the second series, but with the addition of 0·0679 per cent. of the potassium salt of asparagine (amido-succinamic) acid.

Fourth series. As in the third series, with an added amount of 0·133 per cent. of the potassium salt of aspartic acid (amido-succinic acid).

Fifth series. As the fourth in series, but with the further addition of 0·0167 per cent. of tannin obtained from the sugar cane.

The nitrogen compounds, asparagine and aspartic acid, both of which are amino-acids, were introduced to represent the products of protein hydrolysis such as normally occur in cane juice.

The artificial juices were each in turn clarified separately by five different methods, based on those used in actual Louisiana factory practice. In each case sulphur dioxide and lime were used but in varying combinations. After boiling and filtering each sample was then evaporated in a vacuum apparatus at about 70° to one fifth of its original volume. In this way specimens of clarified juice and of syrup were obtained from each of the artificial juices, twenty five specimens in all being thus available for comparison.

The whole process was afterwards repeated with the five artificial juices to which had been added, however, 0·002 per cent. of iron in the form of ferric chloride.

Each product (raw juice, clarified juice, and syrup, was finally subjected to routine sugar-house analysis. The depth of colour of each was also determined by the use of the Hess-Ives tint photometer.

The results of the investigation may be briefly summarized as follows:—

1. On the whole, the presence of small quantities of amino-acids and their derivatives (for example, potassium asparaginate and potassium aspartate) do not seem to exert very much influence on the colour of the products of the clarification and evaporation of cane juice.

2. The presence of lime to marked alkalinity in a limed juice of original composition similar to that of the artificial samples of the fourth series (which contains sucrose, invert sugar, aconitic acid and amino-acids) results in the development of a fairly pronounced colour in the products.

3. In the presence of iron the colour produced, however, is three or four times as great as when iron is absent.

4. If the juice after treatment with lime still remains acid, the colour developed is not very marked, even when iron is present.

5. If sulphur is used in addition to lime, the colour is reduced considerably because of the bleaching action of sulphur dioxide.

6. When the juice is strongly sulphured and then limed back to decided acidity, any decomposition, products of glucose, formed even in the presence of iron, amdio acids, and amides, do not produce any appreciable colour.

   Since this is the method of clarification employed in Louisiana factories, it follows that any colour which develops in the sugar products of these factories must be due to some other factor than the products of the decomposition of reducing sugars.

7. In the fifth series where tannin was present in the artificial juice as well as sucrose, invert sugar, and amino-acid, a pronounced colour developed in all the methods of treatment employed in the boiling house, even when iron was altogether absent.

8. When iron was preeent, the complete juice with tannin, gave the most pronounced colour of all.

9. In the fifth series it was also found that sulphur has some effect in removing colouring matters by reduction, and that excess of lime when used in the clariafication process acted to some small extent in precipitating the tannin, even before it reacted with invert sugars to form the coloured lime-glucose product.

In conclusion Dr. Zerban makes the following statements on the subject of the causes of colouring in sugar products of Louisiana factories. He attributes most of the colouring effect to the presence of tannins in the cane, especially when iron is also allowed to gain access to the juice expressed from it. Oxidation products of cane tannins resulting from the activity of oxidases, as well as anthocyans and saccharetin also play some part in deciding the final tint and depth of colour of the sugar products.

The methods of clarification and decolorization practised in the Louisiana factories do not seem to be completely satisfactory, since they produce clarified juices which are even darker than the raw juice.

It appears that many of the common polyphenol colouring matters of cane juice are colloidal in nature. Chemical methods of clarification and purification, such as are practised in modern sugar factories, do not seem completely to precipitate substances in the colloidal state. Hence other methods may have to be employed, if a high degree of purity is to be gained in the clarified liquors which are to be boiled down to crystallization point. Possibly the applicaton of physical adsorption phenomena such as are already employed in sugar—refining, in which the adsobent properties of bone black. 'Norit,' etc. are utilized for this purpose, may eventually be found to provide a practical solution to the problem.

F. H.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. The quantity of dry rubber collected from four trees in the Botanic Gardens during May and June amounted to 1¼ lb. biscuit and 6½ oz. scrap. Mr. R. O. Williams, Superintendent of Agriculture, states that, with the advent of rain, the ground provision crops are now making good progress. The sugar-cane fields in some districts, notably Morne Rouge, have suffered severely from drought. This is chiefly noticeable on plots where little or no cultivation has been given. A considerable amount of damage to germinating corn by vermin has been noticed. The Agricultural Instructors report heavy infestations of *Aspidiotus destructor* for the time of the year. Two barrels of whale oil soap and a similar quantity of bluestone were imported by the Department.

Plant and seed distribution during the month of July comprised the following: cocao plants, 580; coco-nuts, 50; budded orange and grape fruit, 14; grafted mango 28; yams, 162 lb.; ornamented plants, 331; economic, 53; onion seedlings, 100; Marie Galante cotton seed, 69lb.; onion seed, 4 oz.; lime seed, 2 lb.; *Swietenia macrophylla* seed, 2 packets; sweet potato cuttings, 270; other cuttings, 3 bundles. In addition, a quantity of 'millions' for stocking a swamp at St. Davids were sent out. The rainfall recorded at Richmond Hill during the month of July was 11·39 inches.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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NOTES AND COMMENTS.

Contents of present issue.

Praedial larceny and possible measures for its suppression form the subject of the editorial of the present issue.

Under Insect Notes, on page 282, will be found an article suggesting methods of poisoning grasshoppers.

On page 278 an interesting article is printed dealing with the subject of the colouring matters in cane juices and syrups.

Successful experiments in cotton breeding in Montserrat are referred to in an article on page 285.

Possible future industrial developments in Jamaica are noted on page 275.

The Late Mr. Henry Powell.

The *Kew Bulletin*, No. 6, 1920, records with regret the death of Mr. Henry Powell on June 5, in British East Africa.

Mr. Powell had devoted many years of his life to agricultural service in the tropics. When quite a young man he was appointed in May 1890 as Curator of the Botanic Gardens in St. Vincent. This post he held until November 1903, when he was appointed Assistant to the Director of Agriculture, British East Africa. He was promoted to the post of Chief of the Economic Plants Division in the Agricultural Department of the East African Protectorate in 1907, which post he had only recently resigned.

Sir H. A. Wickham.

We note with pleasure that the honour of knighthood has been conferred on Mr. H. A. Wickham in recognition of his pioneer work in the establishment of the rubber industry in the East.

In 1876, after some exciting and romantic adventures, and in the face of considerable transport difficulties, Mr. Wickham succeeded in deliverinig at Kew some 70,000 seeds of the Hevea rubber tree which he had collected in Brazil. From Kew the plants were distributed to India and Ceylon, and thus the foundation was laid of the vast rubber industry of Ceylon and Malaysia at the present day.

Mites and Lice on Poultry.

Parasites such as lice and mites cause considerable loss in the poultry industry by reducing egg production and hindering the growth of all classes of poultry.

The common poultry mites in the West Indies are known by the name of nimbles; they are entirely nocturnal in their attacks on fowls, hiding in and about the roosting places during the day and swarming out to prey on the birds at night. A cheap and effective method for destruction of these pests is most desirable.

According to *Farmers' Bulletin*, No. 801, of the United States Department of Agriculture, experiments made by F. C. Bishop and H. G. Wood have resulted in the discovery of such a means of control. They claim that sodium fluoride, if properly used, will completely destroy by one application all the lice present on any bird.

Two methods of treatment are recommended; the birds may either be dusted or dipped. If dusting is adopted, it is advised that pinches of the powdered sodium fluoride be placed among the feathers close to the skin on the parts most frequently attacked. Dusting may also be carried out by means of a shaker, but is said not to be quite as effective besides being likely to cause more irritation to the nose and the throat of the operator. The authors however seem to conclude that the application of sodium fluoride by means of dipping is the most effective manner of controlling and destroying these parasites. For the purpose of dipping, from $\frac{3}{4}$ to 1 oz. of commercial sodium fluoride is dissolved in a gallon of tepid water. It is readily dissolved by stirring. In dipping the fowls, the wings should be held over the back in one hand, and the fowl quickly, submerged in the solution, leaving the

head out, while the feathers are thoroughly rubbed with the other hand. The head is then ducked once or twice, and the bird is then released. It is not necessary to keep the fowl under water longer than twenty to thirty seconds, and the head only an instant.

It is estimated that the cost of treatment works out in America at a little less than one cent per bird.

The solution though destructive to the mites does not produce any ill effects on the fowls, beyond occasionally some temporary irritation of the air passages, but it should be remembered that the material is rather poisonous if taken into the stomach.

Artificial Farmyard Manure.

The *Journal of the Ministry of Agriculture*, August 1920, publishes an abridgement of a paper read by Dr. E. J. Russell, F.R.S., Director of Rothamsted Experiment Station, at a meeting of the Farmers' Club in May, on 'Farmyard Manure, its Making and Use.'

Dr. Russell in this paper points out that as the bulk of farmyard manure is the litter, and the valuable part of the residue is largely made up of liquid excretions, it is not difficult for the scientific investigator to make an artificial farmyard manure from straw and artificial fertilizers. This has been done at Rothamsted, and one or two tons of the product were tried on the field. It is too early as yet to pronounce whether the material will work out economically in practice, but the principle is sound; it consists in allowing the straw to decompose with formation of humus, and supplying the necessary compound in the form of an ammonium salt. When the details are worked out the method may probably prove of interest in districts where straw or such like material is available, but where few live stock are kept, and yet where farmyard manure ought to be largely used.

The Odorous Constituents of Fruits.

An article in the July number of the *Journal of the American Chemical Society* draws attention to the paucity of our knowledge of the chemical nature and biological significance of the odorous constituents of ripe fruits.

These odorous substances have commonly been regarded as esters, and a number of artificially prepared compounds of this class have been given names which indicate their resemblance in odour to certain fruits, such as 'apple oil' for amyl valerate, 'pear oil' for amyl acetate, and 'pineapple oil' for ethyl butyrate. The so-called artificial fruit essences are, however, usually composed of a mixture of substances without any consideration of their actual occurrence in the fruit the flavour of which they are supposed to imitate.

An actual identification of the principal odorous constituent of an edible fruit was first accomplished by Clemens Kleber in 1913, who succeeded in showing that ripe bananas contain amyl acetate. This has remained up to the present time the only recorded instance in which chemical identity of a natural fruit flavour has been determined.

The subject, however, assumed a new importance when it was discovered that a somewhat obscure disease of the apple was, apparently due to the exhalation of an ester by the ripe fruit. Power and Chestnut have found that acetaldehyde is a product of the vital activities of the apple, and that it occurs in the exhalation of the ripe fruit. They suggest that this substance may be one of the factors involved in the production of 'apple scald' of ripe apples. It is interesting to note that this disease is almost unknown where a free circulation of air is maintained in storage houses on fruit farms.

It is possible that this observation is of considerable significance to the growers of fruit in the tropics, for it is more than likely than many tropical fruits suffer considerable damage during storage, from exhalations of a similar nature. This subject seems worthy of more serious attention than it has hitherto received.

To Prevent the Rapid Decay of Ripe Fruit.

The *Tropical Agriculturist*, May 1920, contains an interesting article on the above subject. Experiments conducted recently in the Jodrel laboratory, Kew, with the object of ascertaining the value of various substances in preventing the rapid decay of ripe fruit, appeared to point to the conclusion that commercial formalin was most effective, cheap, and easy in application, there being also an entire absence of danger in its use. The method of the treatment is as follows:—

The fruit should be immersed for ten minutes in cold water containing 3 per cent. of commercial formalin, and afterwards placed on wire netting, or some similar material, to drain and dry.

It was found in the Kew experiment that in every case fruit treated with formalin in the foregoing manner remained perfectly sound and free from mildew for many days after the untreated check fruit had become covered with mould, and quite unfit for use. Bananas, for instance, treated with formalin solution, kept sound for ten days longer than the untreated lot.

However valuable the method of preservation alluded to above may be for extending the duration of time in which ripe fruit may be kept in good condition for local use, doubtless the greatest benefit will be in connexion with the export of fruit. Many kinds of tropical fruit which, owing to their rapid deterioration and decay, are never sent on long journeys, may possibly be exported successfully, if treated in this manner before shipment. It is true that many tropical fruits decay very quickly in their native countries, but that only shows that, owing to moist and warm conditions, the spores of fungi, etc., which lodge on the surface of a ripe fruit, germinate rapidly, and attack the tissues, and so set up a fermentation that is often mistaken for normal decay due to over-ripeness.

INSECT NOTES.

POISONED BAITS FOR GRASSHOPPERS.

As is noted by Ballou in his 'Insect Pests of the Lesser Antilles,' sugar-canes in these islands are sometimes injured by attacks of grasshoppers, which eat the leaves, especially of the young canes. It would seem that grasshoppers do more damage to sugar-cane in St. Kitts than in the other islands. These insects may be controlled by use of a poisoned bait; their numbers may also be greatly reduced by collecting by hand, which method, it is stated, has been employed with good results in St. Kitts. Insect-eating birds and domestic poultry, such as turkeys and fowls, feed readily on the grasshoppers, and probably such birds exert a considerable influence in control of the insects.

A standard poison bait may be made by mixing 25lb. bran with 1lb. of Paris green to a stiff mash with water, to which 2 quarts of molasses have been added. Ballou also considers that a cheaper, but equally efficient bait may be employed, composed of a half barrel of fresh horse droppings, 1lb. of salt, and 1lb. of Paris green, thoroughly mixed together.

In a paper published in the *Journal of Economic Entomology*, April 1920, on the subject of poison baits for grasshoppers, the author, W. P. Flint, records some experiments with varieties of poison baits conduct d by him in Illinois. He had noticed that legumes seem to be distinctly attractive to grasshoppers, and he thought therefore that a poisoned bait with a strong legume odour might possibly prove more attractive than the standard bran-molasses bait. Accordingly tests were made using the standard bran mash, and, in comparison, the same amount of bran and Paris green mixed with water, but containing 3lb of finely ground, green beans in place of the molasses. In all but one of these tests a considerably higher number of grasshoppers were kil'ed where the beans were used, as was shown by counts of the dead insects found by carefully examining 5 square yards of the treated fields on the second afternoon after the baits had been distributed. Two advantages are claimed for this bait :(1) that it is considerably cheaper, and (2) that the materials for making it are readily obtainable. It seems to be conclu sively proved that the addition of the ground beans to the water used in mixing the bran and the Paris green, provides a bait quite as attractive as does the addition of molasses, even together with ground lemons, as is usually recommended.

It is sometimes not desirable to use the poisoned bran baits, for instance, in the vicinity of dwelling houses, for fear of killing poultry. To overcome this difficulty, the writer of the article referred to states that some time ago he noticed that grasshoppers fed readily upon paper, especially the heavy brown paper generally used in stores for wrapping parcels. After some negative results had been obtained by soaking such paper in poisonous solutions, an experiment was tried with using Paris green in place of the more soluble arsenical poisons previously tested. In these experiments old newspapers were torn into pieces about 4 inches square, and soaked for half an hour in a mixture of 1 gallon of water to which had been added 1 quarter cup of molasses, 2 ounces Paris green, and 1 ounce salt. Early in the morning these papers were distributed as evenly as possible over a portion of a field in such a manner as to leave the bits of paper about 6 inches apart. A similar adjoining portion of the same field was treated with the standard bran mash, at the rate of about 10 lb. per acre. Counts made the second day from the time of application showed nearly four times as many dead grasshopers per square yard in the area where the bits of paper had been used, as in that to which the poisoned bran mash had been applied. The grasshoppers were still feeding in considerable numbers upon the paper, although they fed very little upon the poisoned bran, except during the first few hours after it was applied. Several later visits to this field showed that the insects continued to feed upon the poisoned papers until they were almost entirely eaten up. The results of two other tests, conducted in the same manner, showed a much higher number of grasshoppers killed in parts of the field where the poisoned papers were scattered than where the poisoned bran mash had been used.

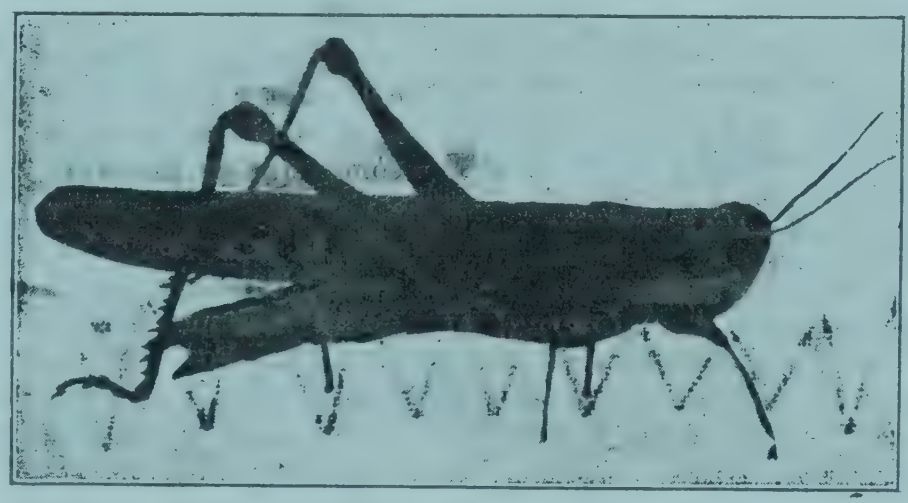


Fig. 14. West Indian Grasshopper (*Schistocerca pallens*). *Slightly enlarged.*

This method of poisoning grasshoppers by the use of poisoned paper seems to have some advantages, as there is evidently less danger of domestic animals or poultry eating the bits of poisoned paper than of their picking at poisoned bran.

Another suggestion for the preparation of an efficient grasshopper poison was the use of a mixture of 20lb of sawdust, ½lb. Paris green, ¼lb. salt, and 3 gallons of water. It is stated that the cost of such a mixture is only one third of the cost of the standard bran and molasses bait. This mixture is said to have proved exceedingly effective in the control of locusts in Eastern Canada.

A note in the *International Sugar Journal*, July 1920, states that a contract has been entered into between the Grays Inn Central Factory Co., Ltd., of Jamaica, and Messrs. George Fletcher & Co, Ltd., for the supply and erection of a sugar factory and distillery for the 1922 crop. The plant is to be capable of producing 10,000 tons of 96° crystals per crop, and about 2,500 gallons of rum, and it will be of the latest type, the whole factory being electrically driven. Moreover, with a veiw to future extension, the whole scheme has been arranged to enable the capacity of the plant to be duplicated in the most economical manner, once the output is sufficiently big to warrant the extension.

MICA IN INDIA.

In a trade report on India published in the *Chamber of Commerce Journal*, July 23, 1920, reference is made to the mica industry of that country. The following information, taken from the above report, is here given as, possibly, from a point of view of general knowledge, it may prove of intrest to readers of this Journal.

It is stated that mica is one of the things, like jute, for which, for certain purposes, no satisfactory subtitute has been discovered, and although it is not, like jute, an Indian monopoly, yet more than half of the world's supply of this material comes from India.

Mica is very widely distributed in India However, the tracts in which it is found in plates of sufficient size to have a marketable value are few and strickly defined. It is in the hilly country that mica is found. It does not occur in thick seams like coal, but in small deposits or 'books', and a mica mine or quarry presents the appearance of a huge rabbit warren, the workers burrowing from 'book' to 'book' by passasges that are often just sufficient to admit a small boy.

In connexion with the working of the mines it is mentioned that, before the war, in most cases very primitive methods were used, the lower levels being reached by means of roughly constructed bamboo ladders, the excavated material was passed, hand over hand, from one miner, to another The baling out of the water was done in the same manner. However, as the demand for mica has greatly increased, and the more superficial deposits have been worked out, more scientific methods are now employed, and mica is being dug by means of shafts 300 or 400 feet deep.

It is stated that from time immemorial, mica has been extensively used in the native arts of India. Besides the well-known use of mica as a substitute for glass in the making of certain articles, such as lanterns, unbreakable lamp chimneys, etc, it is employed in powered form in calico printing, and by washermen to give a spardle to cloth. It is a glazing material for pottery, pictures, and for the backs of mirrors. Indian artists, it is said, have used mica largely for paintings. Mica has also a high reputation in Indian medicine, and is used as a finely ground powder, either by itself or in compounds. It is said to be a tonic. In India where nearly all drugs and articles of diet are placed into two classes—'heating' and 'cooling'—mica is said to be the most efficacious of all the latter class. 'Mica paste' or 'mica grease' is used as a lubricant, also to plaster on boilers to diminish the loss of heat, for one of its many useful properties is that it is one of the best non-conductors of heat. Mica is believed to be the most important constituent of the preparations that are used for painting the insides of iron roofs to promote coolness, and it has also been recommended and, it is stated, is actually used as lining for sun helmets. In these and many other ways mica can be utalized, but its main importance in modern industry lies in the fact that it is the best non-conductor of electricity, and is, therefore, indispensable in electrical engineering. It has been stated that it was on this account that the Government took over part of the mica field during the war, and worked it as a State industry in order to secure a constant supply.

In the report preferred to above it is stated that in former days 80 per cent. of the mica dug from the mines was waste, and great waste dumps of the refuse were seen around the mines and factories where spliting was done. However, a method of cementing small pieces of the mineral together and moulding them into sheets was invented, and by this process a considerable quantity of marketable mica has been recovered from the waste heaps, and a larger proportion of the mineral that is excavated is now being used.

The industry gives work to a large number of unskilled labourers, for even the work in the factories, where the thick pieces are split into thin sheets and cut to proper sizes, is easily learned by women and children, and a daily wage can be earned that is considerably in excess of what is paid for field work.

AGRICULTURE IN BARBADOS.

Since August 8 there has been hardly any rain to be recorded. On that day there was a general rainfall of nearly an inch in the northern parishes of the island. It was stated that nearly two inches were registered at certain estates. This month there has only been on the red soils 3 inches and on the black soils 1½ inches; for the year, 28 inches and 16 inches respectively.

Planters are feeling very anxious over the weather this month, as this is one of the critical months for the growth and development of the cane crop. In some parts of the country, where it is usually cool, the heat has been very depressing, and in the city it has been dreadful.

Considerable progress has been made with the tillage of fields to be planted this year, and already some fields have been completed, and are being manured, and placed in the farmers' hands to be kept clean.

Sheep manure is very scarce now, and planters are anxiously awaiting the arrival of fresh shiploads, as they like to apply this manure several weeks before the cane is planted, in order that chemical changes may first take place in the earth with it. This manure is chiefly used now as a fertilizer where 'early cane manure' is not used, also for potato lands, where farm yard manure is unavailable. Some potato fields so manured have given excellent yields and they have been remunerative.

Large quantities of bush for making farm yard manure are also being cut, and put in the field pens. Manure so made up is of a better quality than that made up of only trash and mould. The soil is enriched with potash and nitrates to a great extent by the use of bush.

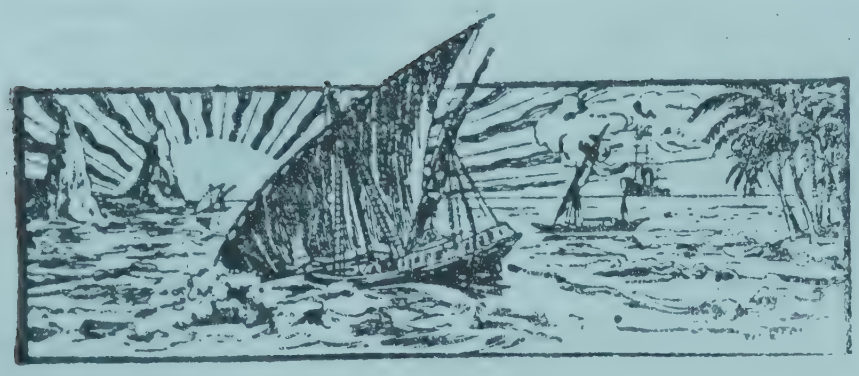
No money is lost in manuring with farm yard manure; in fact, the soil gets back what is yearly extracted from it, and better provisions can be grown in greater quantity where fields have been well tilled and manured.

The yam fields are continuing to develop well, and some excellent and promising fields of white eddoes are to be seen.

Potatoes are still scarce, and the price of them is even on the increase. Six cents per pound is now being paid for them.

The breadfruit season is now opening, and will give some relief. These are being sold in St. Joseph at the rate of eight for a shilling, but they cannot be had in any great quantity yet. The Vegetable Commissioners are once more at work. It is to be hoped that no estate owner or attorney will need to be driven, so to speak at the point of the bayonet, to plant a sufficient quantity of provisions, though the prospects of good sugar prices may make them careless in planting them.

There can be no difficulty in growing potatoes where fields are 'thrown out', and it would be well to see a more plentiful supply of them on the market. (The Barbados *Agricultural Reporter*, August 21, 1920)



GLEANINGS.

According to a note in *Experiment Station Record*, June 24, 1920, about 8 lb of sulphur per green ton of fruit is used in the process of drying fruit in California. The average exposure to the sulphur dioxide fumes varies from four hours to over night, after which the fruit is exposed to the sun for two or three days, and then stacked for the same length of time. Prunes are first dipped in a solution of lye just below boiling temperature.

The most important discovery in the field of alloy steels is that of stainless steel, due to Mr. Harry Brearley. This possesses an unusually great resistance to corrosion either by water and air, or by acids and chemical substances generally. It has proved to be an admirable material for table cutlery, being unaffected by fruit juices or acids. Its great chemical inactivity and good mechanical properties make it specially suitable for automobile parts, and for chemical plants. (*The Times* Trade Supplement, July 31, 1920.)

Since the 1911-12 season, cane sugar has consistently exceeded 50 per cent. of the world's supply, though in 1912-13 its percentage was no more than 50·7 per cent. In 1913-14 it was 52·6 per cent. and in subsequent years it rose to 55·5, 64·5, 66·1, 77·2, 73·2, and in 1919-20 it is estimated at 77 per cent., the supply of beet sugar thus dropping to 23 per cent of the world's sugar supply. These figures demonstrate convincingly the great ascendency the war has given to cane sugar at the expense of its rival. (The *International Sugar Journal*, July 1920.)

Down to the end of March last, progress in the development of the oil bearing lands in Trinidad had been retarded by the difficulty in obtaining delivery drilling equipment. The export however of crude oil and its products in 1919 showed an increase over the preceding year, the figures being 49,000,000 imperial gallons as against 45,000,000 in 1918. The shipments of crude oil, oil fuel, and distillate to the Admiralty constituted the largest part of the oil exported from the colony. (The *West India Committee Circular*, August 5, 1920.)

A review of work on the determination of the hydrocyanic acid content in Sudan grass, undertaken at the Oklahoma Experiment Station, in *Experiment Station Record*, May 1920, states that the Sadan grass contains about one-third as much hydrocyanic acid as do the grain sorghums. As has been found with other sorghums, there is a decrease of hydrocyanic acid with growth, and more of the acid is present in the le ves than in the remainder of the plant A number of determinations indicate that there is more hydrocyanic acid in the plant in the morning than in the evening.

In the *Agricultural Gazette of New South Wales*, June 2, 1920, the following simple recipe is given for the destruction of ants in nests on the ground Mix 1 oz. of borax with ½ lb. of sugar, boil for three minutes in sufficient water to produce a syrup of the consistency of thin honey This mixture can be placed anywhere in the track of the ants, and they will generally all disappear, as it acts as a poison to the young. This poison is said to be particularly useful in cases where ants attack bee hives, as the bees will not touch it, the borax making the syrup repellant to them.

Pea nuts are at present an important crop in no less than twelve of the Southern United States, especially in those regions infested by the cotton boll weevil. The plant, which is a native of the tropics, was introduced very long ago into the United States, but did not become of commercial importance until about 1870. During the last twenty years the production of pea nuts and their utilization for many purposes have increased enormously. In 1918 the pea nut crop of the United States was approximately 53,00,000 bushels, valued at about $100,000,000. (*Farmers' Bulletin* 1,127, United States Department of Agriculture.)

In the *Journal of the New York Botanical Garden*, June 1920, an interesting article is published from the pen of Dr. N. L. Britten, Director in Chief of the Garden, giving an account of a botanical expedition undertaken by himself and several other botanists to Trinidad in the early part of the year. Dr. Britten expresses himself thoroughly satisfied with the results of the expedition, and with the large collection of specimensand plants resulting from field work He says that the Herbarium of the Department of Agriculture of Trinidad and Tobago is the largest and most valuable of its kind in Tropical America.

An interesting note was published in the *Tropical Agriculturist*, January 1920, on variation in coco-nuts. Of five nuts on a bunch of coco-nuts three were green, and two yellow in colour. Two nuts of each colour were planted, but only two germinated, one of each kind. The plant from the yellow nut developed a distinct yellow tinge, with a yellow or bronze midrib to the leaves, and is making less vigorous growth than the plant grown from the green nut. From this it would appear that yellow varieties of coco-nuts have probably originated as sports from normal green varieties, and that, unless desirable on account of other qualities, they should not be planted, because of their slower growth, owing to the chlorotic condition which will probably render them less profitable than the green variety.

The Times, Trade Supplement, July 31, 1920, says that during the war the acetone industry was established in India, although on a comparatively small scale, to meet the demands of local munition factories. It is suggested that the industry should now be developed to supply the extensive demand for acetone in British and other markets. Besides being employed in the manufacture of explosives, acetone will chiefly be in demand in the near future for certain industrial purposes. Although hitherto obtained from the distillation of wood, or by the dry distillation of acetate of lime, it is made in India from the flowers of the Bassia or Mowra tree, which have been found to yield as much as one tenth of their weight in pure acetone.

COTTON BREEDING IN MONTSERRAT.

Very interesting and valuable work with regard to the selection and fixation of desirable strains of cotton has been carried out by Mr. W. Robson, Curator of the Experiment Station, Montserrat, during the last three years. An account of this work appears in the report recently published on the Agricultural Department. Montserrat, for the year 1918-19. The general conclusions with regard to the results achieved by Mr. Robson, which were reported on to the Imperial Commissioner by Dr. S. C. Harland, D. Sc., lately Assistant for Cotton Research on the Staff of the Imperial Department, are reproduced below as of general interest to cotton growers.

'The results of three years' breeding work with Sea Island cotton in Montserrat having been discussed, it is advisable to set forth some general considerations arising from the work as a whole.

In the first place, both in St. Vincent and in Montserrat, it has been shown that Sea Island cotton, as commercially grown, is composed of a mixture of distinct strains which can be separated by self-fertilization and selection Both from the point of view of yield and of the commercial value of the lint, these strains are of varying value.

'Length of staple would seem to be one of the main factors in determining the commercial value Regularity of staple, which can be judged by the estimation of the available fibre, is probably largely influenced by amount and distribution of rainfall, and an island like St. Vincent, which usually has an even distribution of rainfall, will perhaps always produce a more valuable commercial product than Montserrat or St. Kitts.

'Montserrat can produce a good 48—51 mm. staple, which appears to be entirely satisfact ry to the spinner. The negative correlation which appears to exist between lint length and lint weight, and thus with yield of lint per acre, need not be strongly pressed. Much more evidence is still needed on the question, and it must be borne in mind that statistical constants based on a small number of strains are apt to be misleading. This much may confidently be said: Montserrat has a type of cotton with an amount of lint per boll nearly double that of ordinary commercial strains, with a correspondingly heavier yield. If the spinners are led to complain of the spinning properties of this type, it may then be the business of the Agricultural Department to provide another type, which can easily be done. Meanwhile it would seem best to propagate the heaviest yielding type as quickly as possible.

'It must be obvious to all who are concerned with cotton-breeding work that the improvement of Sea Island cotton is a peculiarly difficult matter. Before a new strain can be recommended for cultivation on a commercial scale, it must be tested at all possible points. It must possess satisfactory physiological as well as morphological characters. Two examples will serve to illustrate this point. After four years of work a strain was isolated in St Vincent which appeared to be desirable in every possible respect. Just when it was about to be put into commercial cultivation, it proved to be very undesirable. It was very susceptible to bud shedding, and the seed would not give a good stand of plants, owing to some constitutional defect. The inference is obvious. As long as the attempted improvement of Sea Island cotton is carried on by the mass selection method, there is little danger of losing desirable, or of perpetuating undesirable characters to any great extent. With the adoption of the pedigree selection method, arises the possibility that a desirable character may be dropped out at any point through lack of knowledge of its importance, and that an undesirable character may be obtained in a homozygous condition.

'The work of Sea Island cotton breeding has now become a complex business, and if the work is controlled by those who are not thoroughly familiar with its difficulties, the results produced are quite likely to be disastrous.

'In three years' work in Montserrat and St. Vincent certain definite results have been achieved When the whole series of results is scrutinized, it is clear that a good deal of work could have been saved at the outset, if definite ideas had been held as to what was really required. A type of lint weight of 60 mg. has been obtained. What are the steps which led to its isolation? In the first place, it originated in a family which had a high mean and an upward range in excess of other strains. Its own range is from 50 to 60 mg., and it is clear that selection must begin with a number of plants of not less than 50 mg. In 1915 the present writer made an examination of the lint weight of several hundred plants from a commercial strain. Only two plants out of those examined had a lint weight of more than 50 mg. Thus it would seem that the isolation from a commercial strain of such a type as the Montserrat 60 mg, strain would entail the preliminary examination of many thousands of plants, and even then the required plant might not be found. These remarks are put forward to show what difficulties may arise in breeding for high lint weight from commercial material.

'In regard to lint length in Montserrat, the results show that the strains under examination were excellent, even in 1916, and it is probable that subsequent selection has effected no improvement of commercial importance.

'In undertaking the work of isolating new strains from commercial material, it is obvious that the fullest possible advantage must be taken of the great variation existing in that material. Thus the Montserrat work has suffered to some extent from the fact that only three strains have been worked with. By a fortunate circumstance, families H. 9—23 and H. 9 Th. contained valuable material, but it is quite possible that these might have been inferior, as D. 1 has proved to be.'

Mr. Robson, in his annual report alluded to above, remarks that: 'As the result of all the data accumulated, both as regards field characters, the valuation of the lint by the brokers, and the results of the spinning tests, the seeds of the type showing the best all-round results are used in the following year to plant a seed field—which is grown in co-operation with one of the estates—about 4 to 6 acres in extent, the crop from which is carefully picked, and stored separately in the estate's storehouse. When the cotton is ginned, the seeds are handed over to the Agricultural Department for distrubution to estates, which are allowed sufficient seed to plant one-tenth of the total acreage to be planted on the estate, at the rate of 10 lb of seed to the acre. The acreage thus planted is regarded by the estate as a seed field, which in turn supplies the whole estate with seed for planting in the following season

'As there still remained some doubt, when the seed fields were established in 1917, as to which of the three types, H. 9, H. 23, and D. 1 promised to give the best monetary return to the growers, seed fields of all three types were grown in the season 1917-18 At planting time in 1918 it was considered advisable to recommend the planting of seed fields both of the D. 1 and H. 23 types, until another season's experience indicated which of these two cottons was the most satisfactory. The result was that all the important cotton estates in the island had seed fields of both types in 1918, and, after an examination of all the data to hand, the H. 23 was recommended for general cultivation in 1919.

'This system of seed supply, while not without its drawbacks, and not by any means ideal, is working satisfactorily.'

REPORT ON TWO WEST INDIAN SUGAR FACTORIES, 1920.

In accordance with the procedure of the past four years*it will again be a matter of interest to summarize and compare the results of the working of Gunthorpe's Factory, Antigua, and of Basseterre Factory, St. Kitts, for the season ending July 1920. At the instance of the Directors of these factories, the full results have been furnished to the Imperial Commissioner of Agriculture for the West Indies. For purposes of comparison corresponding results obtained in Java in 1919 are also given below—the figures having been obtained from the *International Sugar Journal* for June 1920, p.322.

The Antigua factory in 1920 manufactured 10,632 tons of sugar from 93,793 tons of cane, and the St. Kitts factory, 9,978 tons of sugar from 86,732 tons of cane. These figures show an increase on the amounts for 1919 and 1918, but are not so high as the corresponding figures for 1917 and 1916. Dry weather has again been the limiting factor.

The weights of cane needed to produce 1 ton of sugar at these two factories in 1920 are respectively 8·8 and 8 6 tons, as compared with 9.3 and 9.2 in 1919; 8·8 and 8·5 tons in 1918; 8·7 and 8 2 in 1917; and 9 1 and 8·7 in 1916.

The main features of the working of the two factories, and of a typical average Javan factory may be gathered from the following tables:

TABLE I.	Antigua.	St. Kitts.	Java. 1919
Canes crushed, tons	93,793	86,732	
Undiluted juice, tons	67.525	66,566	
Diluted juice, tons	90,240	82,503	
Juice expressed per 100 cane	72·02	76 75	
Juice expressed per 100 parts of juice in cane :—sucrose extracted per 100 parts of sucrose in cane	91·89	94 32	92 00
Sucrose in juice, tons	11,232	10,476	
Commercial sugar made, tons	10,632	9,978	
Purity of diluted juice	82 9	83·4	83·70
Sucrose in 100 parts of cane	13·03	12 81	12 38
Fibre in 100 parts of canes	16·90	14 85	13·01
Juice lost (in megass) per 100 fibre	37·58	31·75	
Juice lost per 100 parts of cane	6 35	4·68	
Recovery of sucrose per 100 parts of sucrose in juice	91 03	91 83	88·85
Recovery of sucrose per 100 parts of cane	83 62	86·62	81·66
Tons cane per ton of commercial sugar	8·81	8·64	
Polarization of sugar made	96·03	95·89	96·5
Final molasses made, gallons	490,960	410,000	
Molasses per ton of sugar	46·1	41·1	
Filter cake made, tons	1,350·5	894	
Sucrose per 100 parts of filter cake	548	5·87	3·70

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" XVI, p. 356
" XVII, p. 276
" XVIII, p. 391

TABLE II	Antigua.	St. Kitts	Java. 1919.
Per 100 parts of cane			
Sucrose recovered in sugar	10 90	11·09	10·11
Sucrose lost in megass	1·05	0·73	0·99
Sucrose lost in filter cake	0·08	0·06	0·06
Sucrose lost in molasses	0·98	0·89	0·90
Undetermined losses	0·02	0·04	0 32
	13·03	12·81	12·38
Per 100 parts of sucrose in cane			
Sucrose recovered in sugar	83·62	86·62	81·66
Sucrose lost in megass	8·11	5·68	7·99
Sucrose lost in filter cake	0 60	0·47	0·49
Sucrose lost in molasses	7 52	6·93	7·27
Undetermined losses	0·15	0·30	2 59
	100·00	100 00	100·00

TABLE III			
Composition of Cane Average for the year			
Sucrose	13·03	12·81	12·38
Glucose	1·11	0·96	—
Non Sugars	0·86	1·45	—
Fibre	16 90*	14·85*	13·01
Water	68·10	69·93	—
	100·00	100·00	—

The following items of interest brought out by the above figures deserve attention

The expression of sucrose from the cane by the mills in the two West Indian factories compares very favourable with that of the Java factories, in spite of the advantage which the latter had in that the cane sent to them was of lower fibre content (13 per cent.) than the West Indian cane (16·9 and 14·9 per cent. fibre). The standard of milling in Antigua shows a slight decline on the figure (92·4) for last year but the St. Kitts factory has brought up its figure from 93·9 to 94·3.

The recovery of sucrose from the sucrose of the juice after expression by the mills has been maintained at a good standard in the two West Indian factories being 91·0 per cent at Antigua, and 91·8 per cent. at St. Kitts for the past season. In Java, the sucrose recovery was 88·8 per cent. in 1919.

On the whole, the high level of efficiency at the two West Indian factories has been maintained during the past season. The St. Kitts factory especially has registered an advance in the improvement in the milling work, which was accompanied by a maintenance of efficiency sucrose recovery from the expressed juice. In the case of the Antigua factory there has been a decline since 1918 in the milling work. It is understood that this is partly to be accounted for by a decision to expedite the rate of milling in order to get through the crop in good time.

A comparison of the two essential features of sugar factory work, i e. milling and sugar-recovery, as exhibited by the figures for the Antigua and St. Kitts factories published during the past five years, may prove of interest, and is given below.

1 Sucrose expressed by mills per 100 parts of sucrose in cane

	1916	1917	1918	1919	1920.
Antigua	92·2	93·0	93·8	92·4	91·9.
St. Kitts	93·6	94·4	93·7	93·9	94·3.

*These figures, corrected for 14 roller mill become 15·60 and 13·11. See *Agricultural News*, Vol. XVIII, p. 391

2 Juice per 100 parts of fibre in megass.

	1916	1917	1918	1919	1920
Antigua	38·0	31·0	30·5	35 9	37 6.
St Kitts	40 2	31·7	31·3	34·7	31·8.

3 Sucrose recovered in sugar sold per 100 parts of sucrose in juice

Antigua	91·6	90 8	89·1	91·3	91·0.
St. Kitts	91·4	92·2	92 4	91·8	91·8.

4 Sucrose recovery in sugar sold per 100 parts of sucrose in cane.

Antigua	84 5	84 5	83·5	84 3	83·6.
St. Kitts	85·6	87·1	86.5	86·2	86.6.

5 Percentage of fibre in canes sent to the mills.

Antigua	16·2	17·4	16·0	16·7	16·9.
St. Kitts	13·3	14·4	16 0	14·4	14·9.

NOTES.

The best indication of efficient milling is given by low values for the factor 'juice per 100 of fibre in megass' (series 2 above), since these values are independent of the percentage of fibre in the canes sent to the mills.

The sucrose recovery, by evaporation and crystallization of the expressed juice, as represented by the figures in series 3 and 4 above, furnishes an indication of the efficiency of the processes which follow the milling in sugar factories.

The recovery figures for the two West Indian factories have remained consistently high during the last few years, and surpass the corresponding results of the work of Java factories.

AN IMPORTANT FACTOR IN SOIL BIOLOGY.

The writer of an article which appeared in the *Annals of Botany*, January 1920, points out that though a good deal of attention has been paid in recent years to soil biology, yet comparatively little work has been done on the algal flora of the soil.

The activities of the nitrogen bacteria of the soil are now well established, while those of the attendant protozoa have already received a considerable amount of attention, and the pathogenic effect on higher plants of nematodes, slime-fungi, bacteria, and fungi occurring in soils, is now studied as a special branch of plant pathology. The algae of soils have, on the contrary, possibly on account of their supposed lack of importance as factors in the economy of the soil, been almost entirely overlooked, This is all the more extraordinary, since the researches of Laurent and others clearly indicate that there is an intimate connexion in the soil between algae and the nitrogen-fixing bacteria, and the algae probably play quite an important part in the activities carried on by these organisms. In 1910 Esmarch published a paper on the blue-green algae of the soils of the German African colonies. As a result of his experiments he concluded that cultivated soils are throughout richer in blue-green algae than are uncultivated soils. Meanwhile Robbins published a paper on the algae of some Colorado soils, in which he discussed their probable connexion with the accumulation of unprecedented quantities of nitrates in certain soils in Colorado.

The evidence at pressnt available seems to favour the view that the activity of the nitrogen-fixing bacteria are in a large measure controlled by the algal flora. It is also certain that by their death algae contribute very largely to the fertility of the soil, in that they present considerable quantities of organic material to the putrefactive bacteria for decomposition. Again, if algae are present in any quantity in a soil, their physiological functions of respiration and photosynthesis must have a certain effect upon the nature of the gases in the soil, while their mucous investments probably play an important part, especially in sandy soils, in helping the soil to retain its moisture.

In view of the high degree of bacterial activity in tropical soils, and the marked variations in nitrogen-fixing power which Dr. Tempamy, in an article in the *West Indian Bulletin*, Vol. XVI, page 126, has shown to occur in the soils of the Leeward Islands, it seems probable that a systematic examination of the soil algae of certain of the very fertile soils of St. Kitts might yield results of the greatest importance.

T.G.M.

SIX MONTHS IMPORTS OF SUGAR INTO THE UNITED STATES.

From the Report for June 1920, of the United States Department of Commerce, *Facts About Sugar*, August 21, 1920, published figures showing the quantity and value of sugar imported into that country for the first six months of the present year, from Cuba and other sources

It is stated that records of sugar imports for the half year ended June 30, illustrate in striking fashion the influence of high prices in attracting sugar from sources which do not regularly contribute supplies to the American market. The apex of the price movement was reached in the latter part of May, and the import of full duty-paying sugars during June was more than double that of any previous month of the year and approximately three times that of any preceding month except January, when the existence of a country-wide shortage attracted an unusual amount of outside sugars.

The amount of full duty-paying sugar admitted into the United States for the six months was 291,555 ordinary tons, plus 2,011,365 tons from Cuba, making a total of 2,302,920 tons. In addition, 14,224 tons were received from the Philippines.

The following table shows the imports for each month and the total for the half year, eliminating receipts from the Philippines: —

Tons of 2,000 lb

	From Cuba.	From other countries.	Total.
January.....	215,206	50,096	265,302
Febuary.....	369,175	35,492	404,667
March	426,444	35,824	426,268
April	339,147	25,327	364,474
May	284,289	36,301	320,590
June	377,104	108,515	485,619
Total	2,011,365	291,555	2,302,920

As will be seen from the above figures over 2,000,000 ordinary tons of sugar reached the United Statets from Cuba. This, it is stated, represents, approximately, half the entire Cuban sugar crop of the 1919-20 season.

It is also stated that, counting arrivals from the Phiiplpines among the outside sugars, the receipts of these for the month of June amounted to 116, 120 tons, or almost 40 per cent. of the entire volume of such sugars imported during the six months.

The total value of all the sugar imported during the half year, including that from the Philippines, is said to be placed by the Department of Commerce at $520,075,381.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, August 19.

BALATA—Venezuelan Block, no quotations; West Indian Sheet, 4*s.* 3*d.* to 4*s.* 3½*d.* c.i.f., spot, 4*s.* 7½*d.*
BEESWAX—No quotations.
CACAO—Trinidad, and Grenada, 95*s.* St. Lucia, Dominica, and Jamaica, no quotations
COPRA—£53 10*s*
HONEY—75*s.* to 105*s.*
LIME JUICE—Raw, No quotaions Concentrated, no quotations.
PIMENTO—4*d.*
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs T. S. GARRAWAY & Co., August 31.

ARROWROOT—$8·00 per 100 lb. duty paid.
CACAO—Lottings at 20c.
COCO-NUTS—$52·00 husked nuts.
HAY—Sales at $6·00.
ONIONS—Lottings at $12·00.
PEAS, SPLIT—No quotations; Canada, $13·00 small, $15·00 large.
POTATOES—Sales at $16·00
SUGAR—Market bare.

London.—THE PERFUMERY AND ESSENTIAL OIL RECORD, July 20.

BAY OIL—30*s.* per lb. spot, and 28*s* forward.
LIME OIL—7*s.* 6*d.* for West Indian distilled, and for hand-pressed 25*s.* 6·*d* per lb.
ORANGE OIL—West Indian, 40*s.*

Trinidad.—Messrs. GORDON, GRANT & Co., August 6.

CACAO—Venezuelan, $17·25 to $17·50.
Trinidad, $16·50 to $17·00.
COCO-NUT OIL—$1·45 per gallon.
COFFEE—Venezuelan, 20c. to 24c. per lb.
COPRA—8c. per lb.
DHAL—No quotations.
ONIONS—5c. per lb.
PEAS, SPLIT—$11·00 per 100 lb.
POTATOES—English, 11c. per lb.
RICE—Yellow, $14·50 White, No. quotations.
SUGAR—No quototions.

New York.—Messrs. HUTH, GILLESPIE & Co., Inc. August 7.

CACAO—Caracas, 15½c. to 16c.; Grenada, 14c. to 15c.; Trinidad, 14¼c. to 14½c.; Jamaica, 11c. to 12c.
COCO-NUTS—Jamaica selects, $52·00 per M; Trinidad $48·00 per M; Jamaica, $38·00; Trinidad $32·00 per M. culs
COPRA—No quotations;
COFFEE—Jamaica, 12½c. to 17c. per lb.
GINGER—35½c. to 39c. per lb.
GOAT SKINS—Jamaica, Antigua, Barbados, St. Thomas and St. Kitts 80c.
GRAPE FRUIT—Jamaica, $3·00 to $5·00 per box.
LIMES—$6·00 to $8.00 per bbl.
MACE—33c.
NUTMEGS—21c.
ORANGES—$5·00c.
PIMENTO—8¼c. per lb.
SUGAR—Centrifugals, 96°, 15c.; Muscovados, 89°, 14c.; c. & f., Molasses, 89°, 13¾c.

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We can supply you with the above, selected from Seed grown at the GOVERNMENT INDUSTRIAL SCHOOLS, and the LUNATIC ASYLUM FARM, under the supervision of the Agricultural Department. Lint from this Seed has been highly reported on by the Spinners in England.

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WHITE PARK.
May 15, 1920.

AGENTS FOR PUBLICATIONS OF THE IMPERIAL DEPARTMENT.

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WEST INDIA COMMITTEE, 15, Seething Lane.
Barbados: ADVOCATE CO., LTD., Broad Street, Bridgetown.
Jamaica: THE EDUCATIONAL SUPPLY COMPANY, 16, King Street, Kingston.
British Guiana: THE ARGOSY CO., LTD., Georgetown.
Trinidad: Messrs. MUIR-MARSHALL & Co., Port-of-Spain.
Tobago: Mr. C. L. PLAGEMANN, Scarborough.
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Grenada: Messrs. THOS. LAWLOR & Co., St. George
St. Vincent: Mr. FLORIS SIMMONS, Experiment Station.
St. Lucia: Mr. R. W. NILES, Botanic Station.
Dominica: Mr. W. G. HUTTON, Botanic Garden.
Montserrat: Mr. W. ROBSON, Botanic Station.
Antigua: Mr. S. D. MALONE, St. John's.
St. Kitts: THE BIBLE AND BOOK SUPPLY AGENCY, BASSETERRE.
Nevis: Mr. W. I. HOWELL, Experiment Station.
Canada: LEWIS W. CLEMENS, 801, Yonge Street, Toronto

AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

IMPERIAL DEPARTMENT OF AGRICULTURE FOR THE WEST INDIES.

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The Organization of Cotton Research.

IN the Report of the Third Conference of Research Organization, May 1920, published by the Department of Scientific and Industrial Research, there is reproduced a paper by Dr. Crossley on the 'Relation of Research Associations to Existing Institutions for Research'. In it, Dr. Crossley points out that in view of the fact that existing institutions for research are principally at the universities, where pure scientific research work is carried out, the attitude of research associations toward pure scientific research must be taken into consideration. The supposed differences between scientific and industrial researches are, he considers, non-existent, for there is only one kind of research namely, a seeking after absolute truth by scientific method. The application of truth so established to the founding of a new industry, or to the enrichment of an existing industry, generally requires great and organized effort, which may be classed as industrial research.

All great industrial advances have been the outcome of pure scientific research work; rule-of-thumb methods can carry, and have carried many industries to extraordinary success in the past, but there comes a time when rule-of-thumb fails to make advances, and it becomes essential to know the scientific why and wherefore. Research associations cannot divorce themselves from pure scientific research work; rather must they regard the need for it as the main cause of their existence, and devote their energies to an always closer acquaintance with this soul of industrial prosperity.

The work of research associations must naturally, to a great extent, be selfish in nature, inasmuch as it is work with the definite purpose of furthering the interest of an industry. But this object will necessitate the carrying out of much pure scientific work, and science will, it is hoped, be enriched by the publication of work of this description, and in addition the associations may possibly be of great use to the country in an educational capacity.

It is presumed that the main objects of a research association, supported by the majority of firms in any one trade, will consist in attempting to elucidate some of the larger and fundamental scientific problems affecting the trade at large, problems so complex and exhaustive that any single firm might well

hesitate before attempting their solution. As the outcome of such work it would naturally be expected that there will spring up minor problems of immediate technical importance, which may appeal more particularly to one or two firms. What more natural than that these firms should desire to start research laboratories for the development of their own special problem, and that advice regarding the initiation of such laboratories should be sought from the institutes of the research associations. The research associations will thus have accurate information as to the scientific requirements of the industries with which they are connected and may as a consequence, be able to make suggestions to the universities for special courses. In any case it seems clear that, through the work of the research associations, the universities can be brought into much closer touch with industry than exists at the present time.

Dr. Crossley then proceeded to give an account of the aims of the Cotton Research Association. It would be difficult, he said, to find an industry so well established, and capable of producing such magnificent results as the cotton industry, which at the same time is founded so much on rule-of-thumb methods. It is known that, if one takes raw cotton and passes it through a number of machines and through a number of processes, a cloth will result that will have perfectly definite qualities with which the manufacturers are acquainted. But if, in following the course of the cotton through these various operations, one stops at any one of the machines or processes, and says, 'Why is that done?' the answer is 'Because experience has shown us that it is necessary.' One may say, 'Yes, that is all very well; but what are the actual reasons that make it necessary?' 'We do not know.' Now, if research may be accurately defined as the desire to obtain exact knowledge, then, surely there must be room for a great amount of research in the cotton industry.

It becomes certain then that we shall have to dig down to the scientific foundations on which the industry should originally have been built up, and the one aim which lies before us is, undoubtedly, a more exact and accurate knowledge of the chemical, physical, and botanical properties of the cotton fibre itself.

It must not be inferred that technical problems will not be dealt with in the research institute. Many such pressing technical problems have already been suggested, and they will be attacked as soon as the laboratory accommodation is forth coming. But the main energy of the research institute will be directed to solving the fundamental scientific problems on which the whole industry rests.

It may be asked 'Why not the reverse process? Why not tackle at once the pressing technical problems, and leave the pure scientific research work to be dealt with as time and opportunity arise?' The answer is, 'Because though it may be possible partially to solve the pressing technical problems in a reasonable length of time, their true solution can only be obtained with a more perfect knowledge of the fundamental scientific facts which lie at the basis of the whole question.'

This view is rapidly gaining ground, not only in the cotton industry, but in all industries, agriculture included, and provides one of the few apparent good results of the late war. Science during the war taught every trade that it paid to cultivate her better acquaintance.

There are types of research where the aim is definite and where the means of attaining it are pretty certain. It is simply a matter of hard and consistent work. But there are other problems where the aim is definite, but where the means of attaining it are by no means certain, and the only way in which they can be tackled is by carrying out a large amount of scientific investigation over a very wide field. Into this category falls much of the work which now faces the British Cotton Industrial Research Association.

It will be of interest to consider the first annual report of the British Cotton Research Association, which has just been issued, in connexion with the foregoing.

The Association is composed of 1,408 individual members representative of all branches of the cotton industry. A large mansion some five miles from the Manchester Exchange has been bought for the purposes of the association, to which it is proposed to add extensive buildings, for which it is intended to raise a special fund of £250,000., to acommodate the various apartments of chemistry, physics, colloids, botany, and technology, and to appoint as heads of these departments highly qualified men of science. The plan of research is intended to cover the qualities of the cotton cuticle, and the influence thereon of different reagents employed in mercerization, bleaching, etc., the effect of reagents on the strength and elasticity of the fibre, yarn and fabric; the behaviour of fibres under stress and strain, etc.

Arrangements have been made for co-operation with the Empire Cotton-Growing Committee of the Board of Trade, and in co-operation therewith, the Research Association has made a grant to a student of botany at Oxford, in aid of botanical research in the subject of cotton-growing, The joint committee has also arranged for two other students to take up like work in the ensuing session.

It will thus be seen that the British Cotton Research Association has adopted the policy of working in the closest co-operation with the universities.

THE WORK OF DR. C. A. BARBER ON THE SUGAR-CANE.

The *Agricultural Journal of India* for January 1920 contains an account of the work of Dr. C. A. Barber C.I.E. D.Sc., F.L.S., in connexion with the sugar cane in India,

Dr. Barber, has recently retired from the post of Sugar-cane Expert for the whole of India, to which post he was appointed in 1912. Previous to this, he served as Government Botanist in India, in which capacity he had acted from 1898. Dr. Barber was born in South Africa, and received. his education and training in England and Germany. He obtained an honours B.Sc. degree at London University, and subsequently studied at Heidelberg and Bonn, and later at Cambridge. Dr. Barber was connected with the West Indies between 1891 and 1895, when he was Superintendent of Agriculture in the Leeward Islands.

In India his efforts to improve the sugar-cane industry, and to speed up the production of sugar have resulted in a markedly increased output. In his endeavours in this direction. Dr. Barber has been ably supported by the Madras *Mail*, in which many articles on the subject of sugar production in India have appeared. It is perhaps through his researches on the growth of the sugar-cane that Dr. Barber is best known to planters in the West Indies. A series of memoirs on this subject have appeared in the publications of the Indian Department of Agriculture, and an excellent summary of the salient facts in connexion with this subject have been printed in the pages of The *International Sugar Journal*, in a series of articles contained in various issues of that journal during the past twelve months

As a scientific worker, Dr. Barber is distinguished for accuracy and method, and he is possessed of enormous industry

Since his retirement from active work in India, Dr. Barber has been appointed to the newly created post of Lecturer in Tropical Agriculture at the School of Agriculture, Cambridge, England, and will begin his course of lectures in the coming October term at the University. Everyone interested in scientific agriculture will look forward to many further contributions from his able pen, and will watch with interest an event the realization of which has been so enthusiastically hoped for in the July number of *Tropical Life*, where an article on Dr. Barber also appears, namely the attainment of first place in the race of the world's sugar output by the British Empire.

BEET SUGAR INDUSTRY IN EUROPE.

The following account of the present conditions and prospects of the sugar beet industry in Europe is given in the Paris letter to *Facts About Sugar*, August 28, 1920.

Reports from all sugar beet-growing sections are to the effect that the crop is in exceptionally fine condition, with stands far superior to the normal for this season of the year, and with every promise of a remarkably heavy yield per acre. This applies not only to the French crop, but also to practically the whole of Europe's sugar-growing territory. The favourable conditions under which the best are making their growth are the more welcome in view of the disastrous conditions that marked the latter part of last season. They give reason to hope that the yield of beets—and of sugar—may be materially higher than the estimates set two months or more ago

It is reported that a proposal is being drawn up which will be submitted to the Soviet government of Russia on behalf of the former owners of Russian sugar factories, as soon as peace is declared. Under this plan, while the ownership of the factories will nominally remain with the Soviet government, which appropriated them, as it did all similar properties, the plants will be leased to their former owners for ninety nine years or other long terms at an agreed rental. As Russia is practically without sugar, and the former proprietors arethe only ones with the technical skill needed to operate factories, it is considered possible that some such plan may be adopted which will enable the Russian factories to resume operation.

THE VALUE OF SUGAR AS A FOOD.

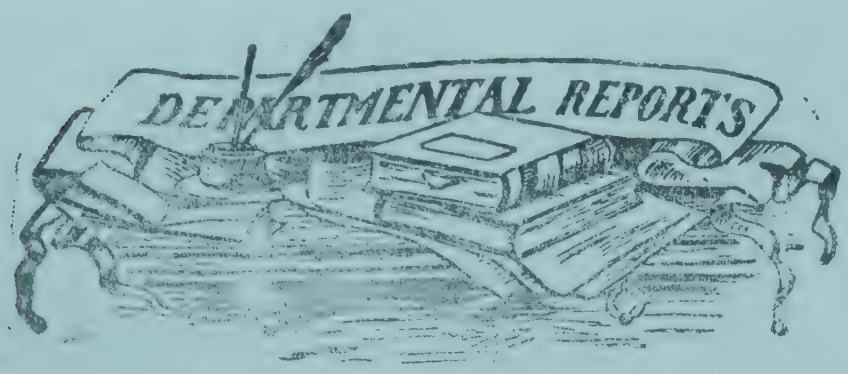
The recent statements of Professor Metchnikoff in connexion with the physiological value of sugar as a human food are not without interest. A short discussion of the question forms the subject-matter of an article in the *Louisiana Planter* for August 28, 1920.

Metchnikoff asserts that old age in the human subject is due to the effect of certain poisons produced by bacterial activity in the organs of the body. As a result of the action of these poisons on the walls of the arteries, and on the liver and brain, the co-ordination of these organs is upset, and loss of vigour and inability to resist disease ensue. It is contended that none of these poisons can be produced by bacterial action on sugar, and moreover, that sugar feeds the useful bacteria that keep disease germs and poison-producing bacteria in check Further, it has been shown that sugar is one of the best foods for keeping the heart strong and steady, and in staving off heart disease The great dietic value of sugar, therefore, lies not only in its force-giving properties, but also in its antiseptic virtues It was in view of these accepted properties of sugar that the sugar ration of the army was recently very largely increased.

DEPARTMENT NEWS.

Miss E. M. Wakefield, F.L.S., arrived from England by the R M. S 'Quillota' on September 8, to act as Mycologist on the staff of the Imperial Department of Agriculture for the West Indies.

Mr. F. G Harcourt, who has been appointed Agricultural Superintendent, Antigua, also arrived in Barbados by the same steamer, and proceeded the next week to Antigua to take up the duties of his office.



BRITISH GUIANA: REPORT ON THE DEPARTMENT OF SCIENCE AND AGRICULTURE, 1918.

Professor Harrison's report on the work of the Department of Science and Agriculture, British Guiana, for 1918, contains much information of value. Its main features are summarizad below.

SUGAR.—In connexion with sugar-cane experiments it is stated that 2,315 seedlings of new varieties were raised, of which 376 were possib'e hybrids, 76 the products of self-fertilization, and the rest of known female parentage. The small number of seedlings raised, contrasted, for example, with the number 27,735 raised in 1917, is due to the exceptionally dry weather of September and October. The chief crosses obtained were between D. 118 and Red Ribbon, D. 118 and D. 95, D. 145 and Java 139, D. 145 and D. 625, and D. 145 and D. 118. A large number of cuttings were distributed to sugar plantations, chiefly from varieties D. 118, D. 625, D. 145, and D. 55. In addition, numerous seedling varieties raised in 1917 were supplied to plantations having nurseries. The average yields and characteristics of the expressed juice from plants of several of the varieties supplied to estates were very satisfactory. D. 367, D. 248, D. 118, D. 181, and D.5, yielding at the South Experiment field amounts of sugar in tons per acre varying between 3·47 and 2·93 in the order named.

Experiments with ammonium sulphate as a manure indicated that low applications, that is, amounts conveying 40 lb. per acre, gave a mean increase in tons of indicated sugar per acre of 1·52, whilst medium applications of 60 lb. nitrogen per acre gave a mean increase of 1·89 tons per acre. The weather conditions, as in 1917, did not allow the higher applications of ammonium sulphate to exercise their full effects. Experiments with phosphatic mauure (superphosphate of lime) showed that the mean gain, when no ammonium sulphate was applied with the phosphate, was 3·4 tons of cane per acre, whereas, when a dressing of ammonium sulphate accompanied the phosphate, an actual decrease of 1·1 ton of canes per acre was registered It is stated that this result is possibly due to the excessive amount of salts added to the soil, which is of the nature of a very impervious clay, rather than to the specific effect of the phosphatic manure. As in previous years, ammonium sulphate appeared to be more beneficial in increasing the yield of the cane crop than nitrate of soda.

Experiments with rice-straw applied to canes as a surface dressing showed that there is a decidedly beneficial result following on such treatment. It is probable that this is due to the improvement in tilth, to the smothering effect of the dressing on weeds, to the augmenting of the supply of soil humus, and to the addition of potash and phosphate, as well as to the addition of nitrogen contained in the rice-straw. The sugar planter is recommended to try rice-straw as a mulch, but is warned not to expect markedly beneficial results until the process has been carried out for several seasons on the same field.

Interesting evidence is given in the report of the fact that the supply of readily available potash in certain British Guiana soils, which have not received manurial dressings of potash since 1892, has become somewhat defective, so that nitrogenous dressings cannot exert their full effect unless aided by applications of potash manure.

In connexion with the results of trials in which the sucrose contents of hybrid canes, canes from self-fertilized parents, and canes of uncontrolled though selected parentage were compared, it is to be noticed that general conclusions drawn from similar trials in 1915, 1916 and 1917 have been confirmed in 1918 This is to the effect that it is possibly more profitable to raise seedlings from canes of high vegetative vigour, and then to select from them those which possess the highest sugar content, rather than carefully to raise canes derived from parents of high sugar content, which have either been self-fertilized or hybridized.

The total area under cane cultivation in British Guiana during the autumn of 1918 was 73,565 acres, a decrease of 4,781 acres on that of 1917 This decrease was solely due to labour causes. A decrease is also reported in exported sugar in 1918, which was 20,106 tons lower than in 1917. The sugar exported in 1918 was 93,901 tons

Professor Harrison comments upon the regrettable disregard of the majority of planters to the proper control of insect pests of the sugar-cane. Possibly the encouragement of parasites obtained by correct handling of egg-masses of the moth borer (*Diatraea* spp) may be found to be more effective in checking the spread of this, the most harmful of the insect pests of the cane in the colony, than the popular practice of cutting out dead hearts. Investigations on this matter are to be initiated as soon as practicable.

RICE.— An increase in the acreage under this crop is reported for 1918 as compared with 1917. The crop was an average one. Trials with different varieties of rice have been continued, as have also the experiments on irrigation of rice fields by artesian well water. In connexion with this latter practice, the decisive statement is made that 'irrigation with anaerobic artesian water, to give full returns, must be accompanied by satisfactory aeration of the soil.' When this is done, there appears to be no doubt that such irrigation is evidently suitable to rice cultivation in the colony.

Owing to the depletion of the staff of the Botanic Gardens, the experimental artificial hybridization of rice was not continued during the year 1918.

Manurial experiments with nitrogenous manures have again shown, as in previous years, that the yield of rice is not improved thereby, but that the only effect is to increase the vegetive growth of the crop, which usually results in it being badly laid by rains.

The intense drought experienced in August and September resulted in the lowest average yield of rice per acre that has ever been recorded in the history of British Guiana.

COCO-NUTS.—A further increase in the area under coco-nut palms is reported for 1918, thus indicating a continuation of the flourishing condition of this industry in the colony.

RUBBER.—The prevalence of Para rubber leaf disease has caused a considerable reduction in the acreage of land devoted to the growth of rubber in British Guiana. In 1917, 5,237 acres were under rubber cultivation, but in 1918 this had been reduced to 3,981 acres. The station at Christianburg had to be abandoned because of the fact that about 95 per cent. of the Para rubber trees growing there became badly attacked by leaf disease. Apparently, when a tree has been at all seriously affected by the leaf disease (*Melanopsamunopsis ulei*), even if it throws off the desease, it

never recovers its earlier vigour. The fungus has also been found to attack the native Heveas, but not to the same degree as the imported Para rubber (*Hevea brasiliensis*). The present position of the rubber industry in British Guiana forms the subject of a considerable discussion in the report. It has been proved that Para rubber grows on suitable land in the colony quite as well as in the East, and that there is little difference in the yields of the trees of the two regions. The comparatively low cost of supervision, and the nearness to the markets of the United States are advantages in favour of the development of the rubber industry in British Guiana. On the other hand it is pointed out that the insufficency of labour necessary to keep the rubber plantations free from weeds, and to tap large areas of trees, as well as the disastrous outbreak of Para rubber leaf disease, present insuperable difficulties to the rapid development of the industry in the colony in the near future.

COFFEE.—The extension of the coffee industry slowly continues. The Liberian variety is now exclusively planted, as it gives higher returns and costs less to produce than Arabian coffee.

CACAO.—The cacao industry in British Guiana is reported to be in a state af stagnation. Experiments, however, are still being conducted, and, so far, the results of these show that under conditions such as those which obtain at the Onderneeming farm, where the trials were carried out, the most successful growth of cacao trees follow when the reduction of shade is the lowest possible compatible with due protection from wind, when deep and sufficient drainage is practised, when the soil is properly aerated and mulched, and when superphosphate and potash are used as a manure.

LIMES.—This is possibly the most promising of all industries for small peasant proprietors in British Guiana. Lime trees flourish on the lighter lands of the colony, wherever they are protected from the wind. It is reported that in many of the lime plantations there has been a noticeable occurrence of flower shedding, so that the crop of ripe limes has fallen below expectation.

GROUND PROVISIONS.—It is pleasing to note that the area under ground provisions is returned at 21,959 acres or 3,712 acres more than in 1917.

The next part of the report presents the acreage under various agricultural products in a series of tables, in which the returns of the various districts of the colony are recorded for 1918, and compared with the returns for past years.

The rest of the report consists of detailed accounts of the work done in the Government Laboratory, the Botanic Gardens, and the Government Farm. It is concluded by extensive meteorological data which are recorded in numerous tables of reference.

Of especial interest is the report of the Economic Biologist. It is herein stated that the invasion of locusts which occurred in 1917, has ended, and that the cultivated areas of the colony are now entirely free from the pest. Interesting information is also given in connexion with investigations undertaken with a view to explaining the increased prevalence of mosquitoes, especially in Georgetown, even during the spell of dry weather which occurred in November 1918. It was discovered that the vat system, whereby fresh water is stored for household uses, is the chief source of the trouble. Vats which are in disrepair, or are not provided with close fitting covers, provide ideal breeding places for mosquitoes of the common house species, *Aedes argenteus*, (*Stegomyia fasciata*). Recommendations are made in favour of the establishment of an efficient sewage disposal plant to replace the pit system now in use.

THE EXPERIMENTAL ERROR IN FIELD TRIALS.

An important contribution to our knowledge of the difficulties which beset agricultural experimenters in their attempts to carry out trials to show variations in the effect of different manures on a particular crop, or to compare the cropping powers of certain botanical varieties of plants, is given in a recent paper by J. Arthur Harris in the *Journal of Agricultural Research*, July 1920. The title of the paper is 'The Practical Universality of Field Heterogeneity as a Factor influencing Plot Yields.'

The author has investigated, by means of mathematical statistical methods, the published results of field trials of various sorts. Data of the yields of wheat, of roots and tops of mangolds, of timothy, of potatoes, of alfalfa, and of other crops were examined, and in each case it was found that the results derived from agricultural experimentation methods now in use were most unreliable.

The reason for this unreliability lies in the lack of uniformity in the soil and growth conditions of the experimental fields. Such 'plot errors' are the most potent cause of variation in plot yields, and the chief difficulty in their interpretation It appears therefore that the importance of the factor of soil heterogeneity, although it has been recognized by many experimenters, has not been adequately emphasized

The statistical analyses of the actual yields of test plots, as reported by experts in various agricultural journals, prove that it is practically impossible to secure fields suitable for carrying out direct comparisons of yields. Unless special precautions are taken, irregularities in the field may have greater influence on the numerical results of an experiment than the factor in crop production which the investigator is seeking to compare.

The conclusions drawn from an examination of the results of trials with cereals, roots and fodder crops were also extended to include field experiments with fruit trees, such as orange, walnut and apple. In all the above the heterogeneity of the field plots proved to be so great that it is open to question whether or no the conclusions drawn from experiments not carried out with all biological precautions, and interpreted with due regard to probable errors, are of any value.

A part of the paper under review is devoted to an investigation of the heterogeneity of a field on the San Antonio Experimental Farm of the Western Irrigation Agricultural Office, with respect to certain physical factors Actual measurements of soil moisture in numerous samples obtained from different parts of the field were made. The results were examined by statistical methods, and it was shown that soil heterogeneity in respect of water content was very great, especially at levels which, in spite of the fact that the water content of the deeper soil layers may serve as a reservoir of moisture for the crop, are usually left out of consideration in the selection of fields for use in plot trials.

The extensive study of published data, as carried out by the author of the paper under consideration, indicates beyond doubt that greater care will have to be taken in laying out experimental plots and interpreting the results of trials. It is sincerely hoped, however, that the invaluable help which statisticians are able to give to agricultural experimenters will, in the future, include constructive advice. Whilst great benefit follows usually upon destructive criticism, yet the experimenter, when once convinced of the errors of old methods, naturally desires to be informed how he can avoid the errors, or how he can correct them. F.H.

CASTOR OIL AS A CROP.

The *Gardens' Bulletin*, Straits Settlements, for June 1920, Vol. II, No. 8 contains a useful article by E. Mathieu on the castor-oil plant in Malaya. It is pointed out that in view of the increasing demand for its products, the cultivation of this plant appears to offer fairly good prospects for the small planter, while the industry of mechanical expression of the oil offers a promising opening for the establishment of up-to-date mills.

The castor oil plant does well in light alluvial loams, well supplied with organic matter, but in thin, clayey soils, and in sandy soils, the growth of the plant is slow, and its seed production is small.

The plant roots deeply, and the ground must receive a preliminary digging to a depth of from 8 to 10 inches, followed by a harrowing and raking. The longer the land is allowed to lie broken and exposed to the air before sowing, the better.

Fresh seeds from healthy plants germinate readily, provided the soil is sufficiently moist. Seeds which have been kept for some time should be softened by immersion in water for a few hours, or a preliminary steeping in a weak disinfectant solution might be useful.

Seeds of the small annual varieties are sown 3 feet apart, or better still, if a subsidiary crop of ground nuts is interplanted, at distances of 2 feet on rows 4 feet apart. The seeds of perennial varieties are usually sown at distances of 6 feet each way, but in the case of large branching plants, wider spacing is perhaps advisable.

As the castor seedling bears transplantation badly, the seeds are planted straight away in the fields. In some cases, however, as many as 10 per cent. have been observed to die in the second month, probably owing to the presence of eelworms in the soil. Such infected soils should not be planted with Ricinus, but, should the discovery be made too late, it is advisable to have a number of seedlings apart in bamboo baskets, to fill the vacancies, after creosoting the earth at the spot.

After germination, no more watering need be given, except in the case of actual drought. No further care is required, except weeding, and keeping watch for caterpillars which must be kept down by hand-picking, and by insecticide sprayings.

The castor oil plant can be interplanted with advantage with other annual crops, preferably the ground-nut (*Arachis hypogaea*) which, besides being in itself a very profitable crop, has the advantage of supplying to the soil some of the nitrogen which the castor oil plant takes out of it.

As the castor oil plant exhausts the soil, it should not be cultivated twice in succession on the same ground. A period of at least two years should be allowed between two crops, and it is necessary to devise a scheme of rotation embracing a series of quick-growing field crops.

The rotation, Ricinus, ground-nut, gingelly, sweet potatoes, is suggested, these crops being adapted to similar physical conditions of soil. After the sweet potatoes, manuring would be necessary, but as the products of the crops themselves, ground-nut cake, castor cake, etc., provide most of the substances required, the cost of manuring is practically reduced to that of application. Although the castor oil plant is considered to be an exhausting crop, much of the plant food it uses can be returned to the soil in the form of ashes, or better still, in the form of a compost.

Picking of the capsules should begin when the calyces turn from green to brown, and the yellow husks become visible. The fields should be gone over once a week, and the operation may last over two months, or less, if maturity is hastened by hot, dry weather. The practice of allowing the capsules to ripen, and drop their seeds to the ground, is only admissible where the Ricinus is grown as a pure crop, and the ground is clean and free from weeds.

The following account is given of the preparation of the seeds: , 'The capsules, collected in bags or baskets, are brought to the store, and thrown in a heap on a clean concrete floor and a square enclosure is made to surround the heap, by putting up boards or iron sheets to a height of 3 feet—this to prevent the scattering of the seeds when the capsules open.

'The heap which must be protected from the rain, is covered with gunny bags for 3 or 4 days, and when a beginning of fermentation has set in, and the capsules have somewhat softened, the heap is opened, spread out, and turned over in the sun. Most of the capsules will have shed their seeds in five or six days.

'The clean seeds, if they are to be made into oil on the farm, must be divested of their coats or husks. To this end, after two or three hours exposure to the sun to heat them, by which the husks are made more brittle, the seeds are passed between horizontal rollers, set at a distance apart from each other just sufficient to break the husks by slight pressure, without squashing the kernels. The husks, being very little, crack easily, and with a very simple contrivance to lead the seeds on to the rollers, a mangle, such as used for the sheeting of rubber, would do very well for this purpose. The husks, though cracked, may still adhere to the kernels: a second passing between the rollers, set a little closer, will insure a further cracking, and the seeds may then be put through the winnowing machine. It may be here mentioned that the husks impart neither colour nor taste to the oil, so that the quality of the oil is not affected by their presence with the seed.

'As a matter of fact, present up-to-date oil-mills, equipped with powerful presses, treat seeds in the husk without taking the trouble of husking them; but with presses of small power, such as would be used on small plantations, the husks would retain an undue proportion of oil in the cake; for this reason seeds must be husksd in the latter case.

'On the other hand, if it does not colour the oil, the presence of the husks in the cake gives it a dark colour, and, moreover, it detracts from its manurial value, in that the husks contains no nitrogen.'

After a brief account of the method of extraction of the oil, the writer gives some figures showing the profit from one acre of Ricinus interplanted with two successive crops of ground nuts in one year. Cutting down estimated returns by one-fourth, to allow for vagaries of season, prevalence of pests, etc., he reckons the profit per acre of the two crops as $396·85, equal to £82 13*s.* 6½*d.* sterling.

In conclusion the author emphasises the fact that castor-oil is not suited for extensive cultivation as a pure crop on a large scale. One of the reasons for this is that it produces normal crops only under such conditions as are quite congenial to it, one such condition being side shade during at least one part of the day. A general experience with the plant in the Straits Settlements seems to be that, grown wild, it yields well, but cultivated in plantations, it hardly yields at all, and the oil is of irregular and, inconstant density.

Evidently the good returns estimated are conditional on optimum conditions of growth being provided, and, in particular, at least in the Straits Settlements, shade from large neighbouring trees seems to be necessary.

THE NEWER KNOWLEDGE OF PLANT NUTRITION.

An article in the July number of the *Biochemical Journal* is worthy of the serious attention of all who are concerned with agriculture. The generally accepted idea of the nutrition of an ordinary green plant is that it requires only a supply of inorganic food material, consisting of minerals, carbon dioxide and water, from which it is able to elaborate the whole of its organic substance. This conception of plant nutrition, which forms one of the main physiological distinctions between plants and animals, has been modified during recent years by the work of Bottomley. Experimenting on the growth of green plants of *Lemna minor* in water culture, he has found that the addition to the inorganic nutrients of minimal quantities of certain organic substances is absolutely essential, if the plants are to grow healthily and normally for any length of time. These organic substances, which have been termed 'auximones' by Bottomley, are apparently similar in function, though not necessarily so in nature, to the 'vitamines', the accessory growth substances which play such an important part in animal nutrition.

The use of water-cultures affords practically the only means of absolutely controlling the food materials supplied to a plant, and water plants are obviously the best suited to such growth, since they normally grow with their roots submerged. This afforded the reason for the choice of *Lemna minor* for the experiment; the results of the experiment, however led to the suggestion that perhaps this plant was peculiar in requiriug some organic addition to its nutrient solution. A number of other water plants have been tested in the same way, and have all been found to grow healthily in the presence of a small quantity of organic material, while in inorganic materials alone they gradually died off, and this was the case, no matter what the nutrient solution employed. The well-known fact that ordinary plants will grow well in water culture is explained by the comparatively large quantity of organic food introduced in their seeds, and it was shown that wheat seedlings, with their endosperm removed at a very early stage, responded very much more quickly to the addition of these organic materials than plants which were not so treated. A number of experiments carried out with cuttings demonstrated the absolute necessity of organic materials for normal healthy growth, and explained the prevalent idea of the unsuitability of cuttings for water culture. All these experiments tend to the conclusion that all green plants require the presence of organic material of a special kind for their maximum growth and development.

An entirely different type of plant, a yeast, has recently been the subject of similar researches on the part of Williams, who arrived at the conclusion that 'a substance of unknown nature is necessary in addition to the ordinary nutrients for the nutrition of yeast cells,' and the effect of the substance is so marked that he suggests that yeast may be used as a biological test for vitamines. He also concludes that this substance is identical with the animal beri-beri vitamine.

That all of the animal vitamines are direct products of plant synthesis appears to be probable. It has been ascertained by numerous workers that animals obtain their necessary vitamines from their plant food. It is now established that plants, in their turn, require growth-promoting substances, or auximones; which, in the case of some of the lower plants, are apparently manufactured by themselves, but which, in the case of green plants, must be supplied from without. Since these accessory substances are essentially organic in nature, thereonly possible source in the case of ordinary green plants is to be found in the organic matter in the soil in which they are growing.

Bottomley has found that the products of the nitrogen-fixing bacteria can function as growth-promotirg substances for the higher plants. It appears that the production of growth-promoting substances, whether plant or animal, is ultimately due to soil organisms, and that the moulds and bacteria of the soil, growing upon the organic matter, produce these necessary substances, which are then absorbed by the plants and utilized in their metabolism, and eventually passed, either in the same form in which they have originally been absorbed, or as some other product of plant synthesis, to the animal in its plant food.

It seems probable therefore, that the greater the bacterial activity in the soil, the greater will be the supply of plant auximones; and the bacterial activity may be concluded to be dependent upon the amount of organic matter present.

It is therefore of interest to find that the ordinary organic manures, which are generally applied to soils in agricultural operations, contain, in varying proportions, substances which are effective as plant growth-promoting substances, or auximones. Such ingredients are also to be found in well-manured fertile soil. A comparison between fresh and well-rotted stable manure shows that the rotted manure is more effective than the fresh material.

The exact nature of these growth-promoting substances is still very problematical, but it has been found that peat contains derivatives of nucleic acid, and that these derivatives are effective in increasing the growth of plants. Microscopic examination has shown that the various auximones have marked influence on the size and the contents of the cell, especially on nucleus, and it seems not improbable that they might supply some essential nuclear constituent.

It is interesting to note that Schreiner and Skinner of the U. S. A. Burean of Soils, have found that nucleic acid and guanine and xanthine are beneficial to the growth of plants, the guanine especially to root development.

The value of organic manures is a well-recognized fact, and stress has been laid on their physical effect on the soil, and on the value of organic matter as food for soil bacteria; but the fact that organic materials may be of direct importance to the plant has not yet received the attention that it merits. A number of physiological diseases in the last few years have been found to be associated with a deficiency of humus in the soil. The mottle leaf of citrus trees in California is a case in point. It seems not impossible that the cause of the die-back of the lime trees will be found to be due to a deficiency of some organic substance which, by limiting root development, prevents the necessary supply of water for the transpiring leaves. It may be that many of these malnutrition diseases of plants will ultimately be found to be, like the food-deficiency diseases of animals, due to a dificiency of some specific growth-accessory substance.

T.G.M.

EDITORIAL NOTICES.

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Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

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NOTES AND COMMENTS.

Contents of present issue.

The editorial is on the subject of the organization of cotton research, pointing out the necessity of the correlation of research both as to cultivation and manufacture.

Under Insect Notes, on page 298, will be found an article dealing with the question of the transmission of disease in plants and animal tissues by insects.

Some notes on manures and fertilizers are published on page 298.

The cultivation of castor oil as a crop in Malaya is the subject of an article on page 294.

An interesting article on recent progress as to the knowledge of the processes involved in plant nutrition will be found on page 295.

The Relation of Aeration to the Growt and Activity of Roots.

The January number of the *Annals of Botan* contains the results of Bergman's investigations o soil aeration and the growth of roots.

The effect of various factors on the form a growth of roots has been repeatedly investigate although little attention seems to have been paid the effect of the surrounding medium on the functional activity. This is particularly true wit reference to their oxygen supply. Very recently, hov ever, Livingston and Free have shown that the fir effect of oxygen deprivation is an interference wit the absorbtion of water by the roots. Bergman results show that the roots of land plants are le developed when submerged than when in moist so The aerial parts of the plant also undergo a sligh reduction in size as compared with the above groun parts of plants the roots of which are not submerge If the submergence be prolonged, the more deep submerged roots die, and new ones are developed or near the surface of the water. An inhibition i the absorbing capacity of submerged roots was ind cated by the etiolation and loss of leaves. Transpira tion is presumably greater under these condition than absorption; the leaves are shed to reduce tran piration, and so compensate for the diminished abilit of the roots to absorb water.

In soils under usual conditions there are abunda spaces between soil particles through which air ca diffuse, so that a supply of oxygen is available for th roots at all times. When the soil is saturated, or ha water present in excess, the air is driven out of th interstices of the soil. The only oxygen then availab is that in solution in the water. Water contain however, only a relatively small amount of oxyge A saturated soil contains an insufficent supply of oxyge for oxygen diffuses slowly through water. This wi necessarily lead to a diminution in the absorptio of water; the consequence of which, in the case cotton, is heavy loss from the shedding of buds an bolls. The ability of plants to withstand deprivatio of oxygen is evidently very variable, and is a factor the first importance in crop production.

Intolerance of Maize to Self-fertilization.

In the *Journal of the Washington Academy Science*, June 1919, there occurs an interesting artic on the intolerance of maize to self fertilization. several hundred strains of maize, which were repeated self-fertilized, only one was found which did not suff a loss of vigour in consequence. Euchlaena, the neares relative of maize, which is generally regarded as a ancestor, shows, on the contrary, no measurable reduc tion in vigour as a result of self-fertilizaton. It woul appear therefore that the intolerance of self-fertilizatio is a character derived from some source other tha Euchlaena. The conclusion is reached that the un known ancestor of maize was perfect-flowered and was protected from self-fertilization by complet proterogyny, i.e. the stigmas are receptive before th

pollen of the same plant is shed. It seems probable that maize has retained the intolerance of self-fertilization of this perfect-flowered, proterogynous ancestor, the protective proterogyny has been lost through the separation of the sexes, a characteristic derived from Euchlaena. In this way it is suggested that the intolerance of self-fertilization of maize may have originated.

Formalin as an Insecticide.

The following, as, particularly interesting with respect to mosquito control, is reproduced fron *The Field*, August 14, 1920.

According to an announcement in *The Times* of July 22 M. Roubaud, of the Pasteur Institute of France, has discovered that powdered formalin, sprinkled on the surface of water in which mosquito larvae are present, is a sure means of destroying them, and hence of reducing the risk of malaria. The method by which the specific is said to act is interesting. The habitual food of mosquito larvae consists in minute solid particles, and hence they ingest the particles of powdered formalin. These latter give off gaseous formalin in sufficient quantities to poison the larvae which have swallowed grains of solid formalin. The reflection immediately arises, may not this specfic be used in horticulture for the purpose of destroying other pests? It would certainly seem likely that this preparation of formalin may prove a valuable addition to the list of stomach poison insecticides. It is to be hoped that tests will be made in this direction, and also to ascertain whether in its solid state formalin may not prove even more efficacious as a soil sterilizer than it is in the liquid form.

The Future of Fertilizer Manufacture.

Dr. M. Whitney, Chief of the Bureau of Soils, Washington, U.S.A., has discussed the fertilizer situation in a recently published scientific paper. He calls attention to the fact that organic nitrogenous fertilizers, such as cotton-seed meal, dried blood, rape cake, etc., are becoming increasingly scarce, because of the demand for these substances as feeding stuffs for animals. In order to maintain the nitrogen supply for the manufacture of fertilizers, it thus becomes necessary to increase the production of compounds of nitrogen obtained by fixing atmospheric nitrogen, as has already been done in recent years in the United States and Norway. There the power provided by mountain streams and rivers has been employed in producing by electrical methods of manufacture such fertilizers as nitrolim and nitrate of lime. It is essential that this new fertilizer industry should be established as a chemical industry, based upon chemical investigation and control, instead of relying on the waste products of other industries for the maintenance of supplies of nitrogenous fertilizers.

There are many possibilities in the utilization of new compounds which have heretofore never been employed, in agricultural practice. Ammonium nitrate has recently become known, because of the existence of considerable quantities of this substance in surplus munitions of war. Its value has been recognized, and agriculturists have learnt how best to use it, Hence it may be possible to establish ammonium nitrate as a regular artificial fertilizer, provided an economical method for its manufacture can be devised. Other compounds, such as ammonium phosphate, and potassium phosphate might also with advantage be studied with a view to their cheap manufacture on a commercial scale. It is probable that in future years many new and concentrated fertilizers may be placed on the market, both in solid and liquid form, and it is to be hoped that adequate trial will be given to them under field conditions.

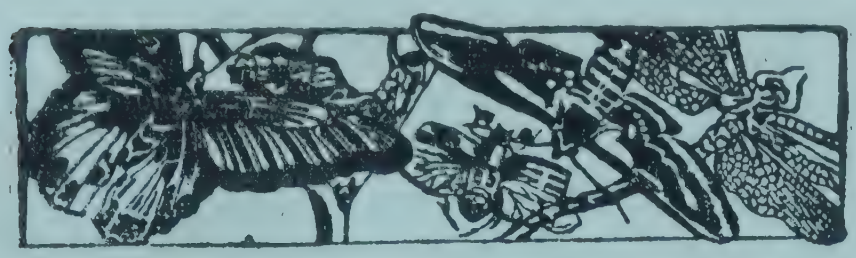
Radio-Activity and Normal Physiological Function.

V. H. Blackman has presented a paper in the July number of the *Annals of Botany*, in which he draws attention to the fact that potassium, which was shown by Campbell and Wood to be radio-active, is a constituent of the bodies of all living organisms.

The radio-active substances are characterized by the spontaneous and continued discharge of rays or particles, which are projected from them with various speeds, sometimes with a velocity as great as that of light. The view put forward by Rutherford and Soddy, that this particular activity is due to a process of atomic disintegration, is now universally accepted.

H. Zwaardemaker, a Dutch worker, has endeavoured to determine how far the action of the potassium ion in stimulating the beat of the heart is due to its radio-active power. It was found that its place could be taken by certain of the heavier radio-active elements. Though the mode of action of these radiations is by no means clear, yet Zwaardemakers's conclusion that 'radio-activity is a mighty biological factor' may well be fraught with the most far-reaching consequences.

Inasmuch as potassium is an essential constituent of plants, it may be that the importance of potassium in the life of the plant is partly due to its radio-active power. In the minuteness of the dose of the heavy radio-active elements required, compared with that of potassium, and in the ease with which a toxic concentration is reached, may be the explanation of the conflicting results obtained by the addition of radio-active earths to soils. In any case, however, there is nothing to suggest the superiority of such earths over simple potassium fertilizers. In cases where, as in the manuring of cotton in St. Vincent, the application of potassium is apparently essential, it would possibly be of interest to determine the value of some of the radio-active fertilizers.



INSECT NOTES.

INSECT TRANSMISSION OF DISEASE IN PLANT AND ANIMAL TISSUES.

An instructive account of the advances which have recently been made in our knowledge of the dissemination of disease in plants and animals by insects is given by Rand and Pierce in the April number of *Phitopathology*. It is pointed out that the transmission of disease by insects has now assumed such gigantic proportions that the time has come to determine whether certain principles may not be found applicable to insect transmission of both plant and animal diseases

It is universally patent that many conditions of disturbed functions and anatomy are caused directly by insects without the intervention of parasitic organisms. Such, for instance, are the local irritations resulting from the bite of tick, flea, or mosquito, and the various forms of insect galls among plants

Insects are also of considerable importance in preparing the way for disease in plants. Egerton, as a result of his idvestigations on angular leaf spot of cotton, which is due to *Bacterium malvacearum*, has found that there are a number of insects which puncture the bolls, and thus aid the bacteria in gaining au entrance. Cage experiments indicate that the bacteria are not directly transported by these insects. Barber too reports that the red-root of sugar-cane, which is caused by the fungus *Colletotrichum fulcatum*, appears in some localities to require a borer hole for entrance, and that it usually does not spread to other parts of the cane from the joint thus entered. While Lewton-Brain speaks of the Melanconium fungus of the rind-disease of the sugar-cane as a wound parasite, which in many cases probably enters through leaf-hopper punctures, he considers that the lowering of the host's vitality by repeated attacks of the insect is of more importance in predisposing to infection.

It is, however, as carriers of micro-organisms that insects have in recent years assumed such importance in the dissemination of disease. The pine apple disease of sugar cane, which is caused by the fungus *Thielaviopsis paradoxa*, is said by Cobb to be assisted in its distribution by insects, and that in all probability they are attracted by its odour. Diseased cuttings are often infested by mites and by the larvae of small beetles of the genus *Carpophilus*. An Examination of these beetles repeatedly disclosed the spores of the fungus on their bodies; it is considered probable that, as they move from cutting to cutting, they spread the disease.

In 1915, Nowell associated the internal boll disease in cotton bolls with the attacks of certain sucking insects. This disease is characterized by discolouration of the lint in the unopened boll, without any external sign of injury. In one series of observations Nowell and his associates found that the disease was absent in the absence of the cotton stainer (*Dysdercus* sp); it was also observed that a high percentage of disease prevailed where the plants were infested with the insects. Punctures with a sterile needle gave nothing but mechanical injnry. Cage experiments with the cotton stainer on the other hand always gave a high percentage of diseased plants, Nowell also discovered a specific fungus causing the disease, and showed that it was carried by, or followed closely upon the attacks of plant-feeding bugs. Control measures have now reduced this disease in St Vincent to negligible proportions.

Among the diseases of man and the higher vertebrates, which are spread by the agency of insects, may be mentioned sleeping sickness, the active organism of which is carried in or on the proboscis of blood sucking insects after they have taken blood from an infected animal. When these insects feed a second time, the parasites are passed into their vertebrate host. Among other diseases which are disseminated by insects are malaria and filariasis, which are too well known to need description.

Among both plants and animals the so-called filterable virus diseases are of fairly common occurence. Yellow fever, that dread scourge of the tropics, is borne by mosquitos. It has been found that the ultimate contagium will pass through a very fine filter. Recently, however, a causative organism has been found.

In the plant kingdom those diseases classed as 'mosaics' fall under this heading. It has only comparatively recently been found that the mosaic disease of the sugar-cane is spread by virus-bearing plant aphids. It is of interest to note that the active agent, whatever its nature may be, can be transmitted to healthy canes by inoculation wit hthe sap of diseased material. It thus appears that the role of the aphis is merely that of a mechanical carrier of the virus.

It will be evident that the part played by insects in the dissemination of plant diseases is one of paramount importance. A great deal more detailed knowledge of the habits and life-histories of the insects concerned is, however, necessary. Much may be learned from the animal pathologist, and a direct collaboration with the entomologist should greatly facilitate the attainment of the ultimate goal

T.G.M

NOTES ON SOME MANURES AND FERTILIZERS.

IMPROVEMENT OF NITROLIM (CALCIUM CYANAMIDE).

In *Chemical Abstracts* (Vol. XIV, No. 13, p. 2,044) is given a summary of a paper by N. Caro, on some attempts to obtain nitrolim (Calcium cyanamide) free from dust, and without the caustic qualities that this artificial fertilizer frequently exhibits in samples.

The presence of very fine dust in commercial nitrolim is chiefly due to unconverted calcium carbide, for it is a matter of great difficulty in the manufacture of nitrolim by passing nitrogen gas over heated calcium carbide to regulate the process so that no carbide remains in an uncombined form at the end of the operation. Extreme dustiness in samples of nitrolim causes great discomfort to the manure spreaders when they are applying it to the land, so that any simple method of reducing this dustiness would be welcomed by agriculturists.

Causticity, the other drawback occasionally shown by samples of nitrolim, is due to a high percentage of free lime (calcium oxide) in the fertilizer. When the nitrolim containing a high percentage of free lime is spread over land bearing a crop in the seedling stage, the lime in it frequently

injures the young plants by scorching them. The presence of free lime in nitrolim is of course no disadvantage when the manure is applied to land carrying no crop; indeed the lime adds to its value when the fertilizer is used for improveing heavy clay soils, for the beneficial effects of lime in ameliorating the texture of such soils are well known.

In the account cited, the author describes the results of various attempts to obtain dust-free and lime free nitrolim.

'Addition of water as a binding agent is unsatisfactory; although the carbide certainly undergoes decomposition, yet the lime, being in a "dead" condition, remains practically unchanged, and further, the water itself causes decomposition of the cyanamide. Most of the remedies suggested, such as addition of colloids, or chloride of calcium or magnesium are unsuitable, inasmuch as they require water as a vehicle. If the amount of water added is much reduced, decomposition will not take place, but the binding qualities will not be permanent. Addition of the water in the form of crystalline salts led to no good results, nor did mechanical treatment of the mass by sieving or pressing after mixing with water prove effective. As a binding agent, paraffin oil gives most favourable results. It is essential that phenols should be absent, as these deleteriously affect the fertilizing power of the nitrolim. To neutralize the caustic action of the product, sugar or sugar containing solutions, derived from molasses or cellulose manufacture, may be added. The sugar combines with the lime to form sucrates, and fulfils a three-fold purpose, inasmuch as it also acts as a binding agent for the dust, and aids the action of the fertilizer by development of bacteria The water which is introduced with the sugar solution is to a large extent retained by the colloidal matter present, and its effect on the nitrolim is very slight. The admixture of nitrolim with other fertilizers is not industrially, practicable as the mixtures are either too low in nitrogen content or are unstable.'

CHEMICAL IMPROVEMENT OF NITROLIM (CALCIUM CYANAMIDE).

Crude nitrolim besides having the drawbacks described in the above article, has the additional disadvantage, that the nitrogen in it is not rendered available to plants when it is applied to soil at a sufficiently rapid rate.

Recently Baumann (*Chem. Zeitnug* 44: 1920) describes attempts to obtain nitrolim in which the nitrogen is in a more suitable form. A promising method consists of combining the process of the manufacture of nitrolim from calcium carbide with that of the manufactures of sodium bicarbonate by the ammonia soda process. In this latter process, a solution of common salt highly charged with ammonia is allowed to trickle down a tower up which carbon dioxide gas is being forced. Ammonium chloride results as one of the products of the reaction, and it can be obtained from the liquors by fractional crystallization. It is this residual ammonium chloride that is of value as a fertilizer, and the proposed scheme aims at the simultaneous production of this compound and of nitrolim, for, by varying the conditions of the reaction, both nitrolim and ammonia gas for use in the ammonia-soda process, can be obtained from calcium carbide and nitrogen, and considerable economies are effected in this way. The ammonium chloride present in the final product has certain advantages as a manure over ammonium sulphate, amongst which the most important is that it may be mixed with acid fertilizers, such as superphosphate, without decomposition of the ammonium compound. resulting in the loss of ammonia, taking place.

F. H.

CLIDEMIA HIRTA IN FIJI.

In a note published in the *Agricultural News* for May 3, 1919, attention was drawn to the danger attending the introduction of uncultivated plants from one country to another. The case in point was that of *Clidemia hirta*, a native of the West Indies and British Guiana, which when introduced into Fiji became an agricultural pest.

An interesting sequel to this story is now to hand in the first number of the new *Agricultural Circular*, January 1920, issued by the Department of Agriculture, Fiji.

Reports were received that *Clidemia hirta* was being killed by a disease. Investigation showed that diseased areas were widespread, and occurred chiefly on the poor red soil overlying the soapstone, rarely on the richer alluvial flats, and more frequently in open country than in the bush. The affected patches were very conspicuous, generally occurring on hillsides or hilltops where the plants had the appearance of being very badly windswept, or even at times of having been over-run by fire. The patches were usually clear-cut, as if radiating from a centre of infection.

Individual plants were found to be dying-back from the tips, and the roots to be in a very unhealthy condition. Very few rootlets were present—those that remained bore small nodules—and the larger roots also were frequently swollen. In the dead twigs beetle borings often occurred, and in all parts of the plant fungus mycelium was found. In the nodules, in specimens from several districts, nematode eggs were found, apparently belonging to the genus Heterodera.

Appearances led to the conclusion that the primary cause of the diseased condition was the nematode. The various fungi found enter through wounds made by the nematode, and may cause more serious damage, judging by the fact that on one estate where fungi were most abundant, the disease was most marked in its effect.

The practical importance of the disease is that in the areas affected the Clidemia is dying out, and valuable crops, such as paspalum and reeds are replacing it.

As an experiment, diseased plants of Clidemia have been planted in close proximity to certain plots of cultivated crops. Even should the nematode prove harmless to these particular crops, however, the idea of employing it generally to exterminate Clidemia is not one to be encouraged. Both nematodes and root fungi are serious enemies of economic plants, and should the Clidemia parasites transfer their attacks to some cultivated crop, the results might be very serious.

E. M. W.

British Columbia possesses timber resources of such an extent that she can supply the needs of a world market. The annual cut of timber in British Columbia is at present in the neighbourhood of 1,500,000,000 feet, board measure, and that this quantity—large as it is—could be increased, is shown by the fact that the total estimate of standing merchantable timber in the province is no less than 400,000,000,000 feet, board measure, which, is more than half the total of all Canada One particularly favourable feature in regard to facilities for export is that, on account of the mild climate, the harbours do not freeze in the winter, and logging can also be carried on the whole year round. (The *Chamber of Commerce Journal*, August 6, 1920.)

GLEANINGS.

The food supply has become something of a problem in Ceylon, especially in regard to rice, which is the staple food of the people: About 30,000 tons of rice over and above that produced in the island are required monthly to meet Ceylon's needs. For the last nine months the supply has worked out at little more than 21,000 tons per month. A period of real scarcity is therefore unavoidable. (*United Empire*, August 1919.)

In the Report on the Agricultural Department, Montserrat, 1918 19, there appeared a note on Vilmorin's stringless bonavist bean, which has been distributed in many of the West Indian islands. It is a most useful garden bean. By planting a row or two at intervals of six weeks or two months, a continuous supply of a useful vegetable can be obtained throughout the year. The pods may be used when young as an excellent substitute for French beans, and the fully developed beans when cooked are palatable and very tender. This variety is worth attention by growers of garden crops.

The value of two species of Canavalia, the 'sword bean' (*C. gladiata*) and the 'horse bean '(*C. ensiformis*) as green dressings has often been pointed out in issues of this Journal. According to the Report of the Agricultural Department, Montserrat, 1918-19, *C. gladiata* possesses an advantage for the purpose over its congener under conditions obtaining in that island, owing to the fact that, in addition to its greater vigour, it is much longer lived, and can be depended on in suitable situations, when planted about the month of April, to give a continuous cover to the ground for nearly twelve months from the time it is established.

As is well known, at the time of the American Civil War the cultivation of cotton in these West Indian islands was extensively undertaken. From an interesting extract of an old estate's letter book in Montserrat, a copy of which has been forwarded to the Imperial Commissioner of Agriculture, it appears that in that island a variety of cotton known as 'sugar-loaf' was considered at the time to be the best for cultivation under local conditions. In 1862, from samples sent to Lancashire for examination, the lint was valued at from 2*s*. 2*d*. to 2*s*. 4*d*. per lb., and was prononnced to be equal to any American cotton except Sea Island. It is stated in the same letter that the average yield per acre of the 'sugar-loaf' was estimated at no less than 400 lb. of ginned cotton.

The consumption of sugar in Australia is said to be greater than in any other part of the world, the average comsumption being 102 lb. per head per annum for every man, woman, and child in the Commonwelth Hitherto the price of sugar has been lower in Australia than elsewhere in the Empire, owing to the production from its own sugar-cane plantations. Consequent on the recent sharp rise in the price of sugar vigorous efforts are now being made in Victoria and Western Australia with a view to supplementing the cane-sugar industry of Queensland and New South Wales by putting extensive areas under sugar beet. (*United Empire*, August 1920.)

The yield of wheat in the United States is estimated at 101,130,000 quarters for 1920, or 14 per cent. less than in 1919, and 2 per cent. below the average production of the five previous years. In Canada the yield is estimated at 37,690,000 quarters, or 50 per cent. greater than in 1919, but only 18 per cent. above the five years average. Other cereal crops, barley, oats and rye, are also favourably reported on as likely to be higher than the average. This is good news with regard to the world's food supply. (*The Field*, August 14, 1920.)

To anyone acquainted with the ordinary cacti of the West Indies, it seems very astonishing that material for producing rubber can be extracted from these plants. Yet an article in the *India Rubber World*, August 1, 1920, states that the writer, Emmet S. Long, after experimenting with a spineles opuntia developed by Berbank, and a spiny wild opuntia, 'prickly pear', of the Arizona desert, he is of opinion that gum in every way equal to guayule, and in some respects superior, may be obtained from these plants. If this should prove to be correct, a new and important industry, that of the production of rubber from the desert and waste lands of Arizona and California, may be developed.

The report of the Committee appointed by the Board of Trade to investigate the question of increasing the flax supply in the British Empire has been issued, and is commented on by the *Chamber of Commerce Journal*, August 6, 1920. In considering the question of substitutes for flax, the Committee are of opinion that ramie fibre can be used for certain articles, and that there are almost unlimited supplies of this raw material to draw upon. The Committee consider, however, that no substitute can satisfactorily replace flax in the manufacture of fine linens, damask, and similar articles; and the conclusion is reached that the extension of the cultivation of flax is the means whereby the difficulties now confronting manufacturers of linen may best be overcome.

One of the commonest plants in swampy lands on the coasts of the West Indian islands is the white mangrove (*Avicennia nitida*). This plant is remarkable for the manner in which it sends up roots in large numbers through the mud which project several inches into the air. It is a large arborescent shrub, the surface of its leaves being usually coated with minute crystals of salt. From a note in the *Agricultural Journal of India*, May 1920, it appears that the branches of a plant of the same genus (*A. officinalis*) known in India as 'livir', are in some districts cut and fed to cattle. The 'livir' also displays the same peculiar root system as the white mangrove of these islands.

DEPARTMENTAL REPORTS.

MONTSERRAT: REPORT ON THE AGRICULTURAL DEPARTMENT, 1918-19.

The report under review, which has recently been issued, was delayed in its publication owing to difficulties attached to getting printing work done quickly at present. Nevertheless, it is a report containing much matter of more than temporary interest and importance.

The opening section dealing with work in the Botanic Garden and Experiment Station has an interesting note on hedge plants, with respect to which work has been carried on for the last twenty years. It is considered that probably the best hedge plant for use locally is the 'bread-and-cheese (*Pithecolobium Unguis cati*). It appears that this plant is especially subject to parasitism by the 'love vine' (*Cuscuta americana*), which, however, can be eradicated if, when first noticed, the precautionary measure is taken of cutting out the young parasites. It is noticed that this parasite does not seem able to thrive on the bay trees. Two other useful hedge plants are mentioned: 'governor plum' (*Flacourtia Ramontchi*) and 'sweet lime' (*Triphasia aurantiola*).

The largest section of the report is naturally devoted to consideration of questions relating to to the cotton industry, seeing that the present prosperity of Montserrat is largely due to the successful cultivation of Sea Island cotton. The work of the present Curator, Mr. W. Robson, which has extended over several years, on the problems of selection and improvement of the strain of cotton most suitable to local environment, is of permanant value. The results, as recorded in the report under review, are extremely interesting'

In the previous issue of the *Agricultural News*, the general conclusions arrived at by Dr. Harland, lately Assistant for Cotton Research on the Staff of the Imperial Department of Agriculture, were published, giving his opinion as to the work in Montserrat in this direction. A particularly promising selection from one of the strains is now being experimented with. This type is designated H.23-2-13, and has been found to possess a remarkably high yielding capacity, an average lint index of 6·02 grams having been obtained from the examination of fifty individual plants, with a range of from 5·11 to 6·84 grams. It seems possible that further selection may yet raise the lint index to a higher figure. Special attention will be paid to this strain in the future, seeing that the factor of high lint index is correlated with the high proportion of lint per boll, and consequently with yield of lint per acre.

Trials conducted for a second season, in order to determine whether there was any increase in yield of cotton obtained by growing two cotton plants to a hill instead of one plant only, confirmed the results of the previous season. The actual gain in crop from the rows with two plants to a hill, as compared with those with only one, was 20 per cent. in 1917, and 23 per cent. in 1918. In each case the plants were 2 feet apart in rows 4 feet apart. The practice therefore of leaving two plants to the hill on land where similar conditions obtain as those at the Experiment Station in Montserrat would seem to be fairly well established

The area planted in cotton in the season 1918-19 was 3,167 acres, and the amount of cotton lint produced amounted to 1,211 bales, or 438,222lb. This constitutes a record output for the island. It will be seen that the average yield of lint per acres was only 138lb., which is low compared with the average yield for the sixteen years since the introduction of the Sea Island cotton industry, that average being 145.3lb of lint per acre. In the season 1910-11 the average rose at high as 197lb. With regard to the reduced average yield for the season under review, it must be remembered that the present high price of cotton has resulted in the planting of a much larger acreage than usual, and this necessarily includes a considerable area of land not specially suited to the crop, which thus reduces the general average return.

It is interesting to note that of the total area mentioned above, 1,417 acres were cultivated on estates by paid labour, 950 acres were grown on the share system, while a further 800 acres were grown by peasant cultivators on their own or rented lands. It may be considered that in the season under review the small grower was directly interested in at least 50 per cent. of the total acreage planted in the crop.

Turning to the lime industry, many problems attaching to the cultivation of this tree are dealt with in the report under review, and it is evident that the work being carried out in the attempt to solve them will ultimately result in benefit to those engaged in the cultivation of lime trees, which is carried on in Montserrat on a great variety of soils, from light sands to heavy clays.

The total output of lime products for the year 1918, calculated in gallons of raw juice, was equal to 142,277 gallons, somewhat below the average output of the last six years 1913-18, which was 146,702 gallons, and considerably below the average output of the four years 1909-12, which was 222,025 gallons.

In 1916 it would seem that the sugar industry was likely to regain to a certain extent its importance in Montserrat, 417 tons having been exported. During the year under report, however, the exports only amounted to 41 tons, and it is stated that the area under sugar cane has been very much curtailed on account of the greater attraction of cotton cultivation, especially to small growers.

The cultivation of the bay tree is receiving a considerable amount of attention, largely owing to the valuable experimental work carried out by Mr. Robson. It has been fully demonstrated that the bay tree is a valuable crop plant on regularly established areas, and that it is a remunerative crop. Mr. Robson considers that cultivation expenses of bay trees do not exceed £1 per annum per acre, and that after deduction of expenses connected with reaping, distillation, and transport of the oil to London, the handsome profit of £33 was obtained from the acre experimented with.

It would seem that the minor industry of the production of papain is on the decline, although a very considerable development in the cultivation of papaws, as a source of the drug, would be possible on large areas in the vicinity of the mountains on the lower slopes in sheltered situations, especially if better methods of culture were adopted. The usual practice of simply clearing certain portions of forest land, and allowing papaw plants to develop from seeds dropp d by birds or other agents, is not one calculated to produce good results.

The overwhelming attraction which the cultivation of cotton seems to possess for planters in Montserrat is natural under the circumstances, but it would be a pity if minor industries, such as papain, bay oil, and onions should be entirely neglected.

Montserrat was famous forty or fifty years ago for the abundance of local foodstuffs and fruit produced. In these directions it is hoped that further progress will be made in the future.

DOWN THE ISLANDS

ITEMS OF LOCAL INTEREST.

GRENADA. Mr. Williams, the Superintendent of Agriculture, states that during the month of August the lime trees of the experiment plot at Morne Rouge have improved. From the Grand Etang Jippi-Jappa straw has been prepared, and samples have been sent to New York for valuation. Plant distribution for the month included 750 cacao plants, 16 grafted mangoes, 37 other fruit plants, and 130 ornamental plants together with 2 lb. of lime seed, and 4 bundles of cuttings. Some seedling grape vines have been planted in the nursery at the Botanic Gardens, and camphor plants, many of which are growing but slowly, have been repotted. It is interesting to note that good crystals of camphor were obtained from a trial distillation of material derived from an old tree at the Gardens. As regards insect pests, Mr Williams says that no bad attacks of thrips have been observed on cacao estates, though some attacks have been reported on peasants' holdings; in this case a spraying demonstration was conducted by one of the Agricultural Instructors. Cotton stainers were noticed in a stock of cotton seed in a local store; the seed was fumigated, and the yard sprayed. Mr. Williams says that on one estate where attention is being paid to rubber, the curing house is now complete, tapping is being steadily continued, and the yields are encouraging. On paying a visit to another estate, on which several hundred Hevea trees have been planted, he advised that the trees were not yet of sufficient size to be tapped profitably. Experiments for the control of black ants with calcium arsenate have given only negative results, nor could the employment of flowers of sulphur for the purpose be described as an effectual means of control. Rainfall for the month at Richmond Hill was 7·10 inches.

ST. VINCENT. Mr. Jackson, the Agricultural Superintendent, states that in the Experiment Station plots for experimental purposes have been planted in cotton, sugar-cane, sweet potatoes, and tobacco. The plant distribution for the month was 26 Manila hemp plants, 2,300 sweet potato, cuttings and 37lb. cotton seed. The appearance of the cotton crops is promising, but in most places more rain is needed. The supply of ground provisions is improving, and fruit is plentiful. The rainfall for the month was 7·82 inches at the Botanic Garden, and 5·96 inches at the Experiment Station.

ST. LUCIA. The Acting Agricultural Superintendent states that during the month of August work in the experiment stations and the Botanic Gardens was of a general routine character. Plant distribution for the month consisted of 900 lime plants, 520 *Coffea robusta* seedlings, 8 grafted mangoes, 12 other economic, and 89 ornamental plants, and 50 cuttings of *Gliricidia maculata*. There were also distributed 30 lb. of Indian corn, together with 3 packets of vegetable, and 12 packets of ornamental plant seeds. With regard to the sugar crop, it is stated that although the spring of the young crop, both of plants and ratoons, had been excellent, growth had been retarded by the comparatively dry and hot weather. The lime crop is satisfactory throughout the island, and reaping is in full swing. There were brought to the Government Lime Juice Factory during the month 600 barrels of limes and 4,870 gallons of juice; the quantity of the juice handled being 9,679 gallons. The cacao crop is generally backward, but promising. The rainfall at the Botanic Gardens, Castries, was 7·38 inches and at the Agricultural Station, Choiseul, 5·07 inches for the month. The efforts for stimulating increased planting of food crops are being continued. At a meeting of the Agricultural and Commercial society suggestions were put forward as to steps which might be taken for protection of planted ground provisions, and for increased facilities of transport.

DOMINICA. Mr. J. Jones, the Curator, states that during the month of August the regular horticultural operations were carried out on the lime and cacao experiment station and in the Botanic Gardens. There were shipped to London by the Agricultural Department 13 bags of cacao and 2 bags of kola nuts; there was also shipped 1 barrel of nutmegs to Mobile, Alabama. The distribution of plants included the following: limes, 2,625; vanilla, 500; pois doux, 400; budded citrus, 14; grafted mangoes, 3; miscellaneous, 51, making a total of 3,593. Besides, there were sent out 300 shade-tree cuttings, and 204 packets of vegetable seeds were sold. The rainfall for the month was 8·76 inches.

MONTSERRAT. Fairly good rains during the month of August, Mr. Robson, the Curator of the Botanic Garden says, have caused improvement in the condition of crops in the experiment plots connected with the Station. A large second crop is expected now from the cotton breeding plot. There were distributed during the month 100 sweet potato cuttings and 110 packets of various kinds of beans. A new experiment plot of $\frac{1}{4}$ acre has been planted with limes at the Experiment Station, and this is interplanted with pigeon peas. It is interesting to note that fruits of the cross between the Rangpur and the ordinary lime are being collected. Experiments are also being made with a vigorous growing fodder grass introduced from Bermuda. Four distillations of bay leaves were made during the month of August; the total weight of bay leaves reaped from the experiment plot for the year being 5,600lb. Owing to the recent rain new growth has been made by the cotton on good lands, but, with regard to the crop of the island as a whole, Mr. Robson does not think that it is likely to exceed 300,000lb. Slight attacks of cotton worm have been reported from two districts, and infestations of cotton stainers from two others. As in other of the islands, it appears that the local food crops are exceptionally scarce, and the Curator is making vigorous effort in propaganda work in order to encourage more extensive cultivation of provisions. The rainfall for the month at Grove Station was 6·25 inches, making a total for the year up to date of 27·38 inches.

ANTIGUA. Mr. A. Gallwey, the Acting Curator of the Experiment Station, writes that towards the end of August the protracted drought was broken by a fall of rain, which enabled plots of various plants, which had failed owing to the dry weather, to be replanted. From the Station there were distributed during the month 10 packets of vegetable seeds, 60 coco-nut plants, and 4lb of onion seed. This onion seed was imported in 1919, and has been kept at the Botanic Station, stored over quicklime. Selected cotton seed was sold during the month to the amount of 576lb., making the total quantity sold for the year to date 4,127lb. The growing cane crop throughout the island is very backward, and requires continuous rain for the rest of the year. In some parts of the island the young cotton crop looks remarkably well in spite of the dry weather. In other districts cotton is only now being planted. The rainfall for the month was 3·29

inches, making a total for the year of only 16.03 inches With regard to peasant holdings, The Acting Land Officer states that the ground provision crops are making good growth, a considerable amount having now been planted, especially under Indian corn. In some localities, however, this latter crop was badly attached by the corn ear worm.

ST. KITTS. The weather during the month of August was so dry, Mr. Shepherd, the Agricultural Superintendent, states, that the agricultural operations in the Experiment Station were at a standstill. A good rain, however, fell at the end of the month. As a consequeuce of the drought many of the large trees in the Botanic Garden have died, and also a number of ornamental plants. The cane crop throughout the island has been seriously affected by the continued dry weather, and, unless good rains continue to fall, Mr. Shepherd thinks that there is a very poor prospect of a sugar crop. The canes at the present time, both plants and ratoons, are low and stunted. The cotton has been much improved by the rain at the end of the month, and there is some hope of a remunerative crop. At a meeting of the Agricultural and Commercial Society on August 14, a resolution was passed asking the Government for the extension of the time for pulling up old cotton plants owing to the abnormal drought; this extension, however, not to interfere with the date of planting the new crops. The rainfall for the month was 3·68 inches, making a total for the year of 21·01 inches.

NEVIS. Mr. Howell, the Agricultural Instructor writes that the weather has been more favourable in that island during the month of August, and the condition of the crops at the Experiment Station have been much improved. The following were distributed from the Station during the month: 1,500 sweet potato cuttings, 100 cassava cuttings, and 2lb. rounceval peas. The young sugar-canes are still looking badly owing to lack of rain, but the cotton crop throughout the island though late, looks promising The cotton worm attached some of the earlier fields, but as measures of control were promply taken not much damage was done. A fairly large area has been planted during the month in provision crops, and special efforts are being made to encourage the production of local foodstuffs The rainfall for the month was 4·71 inches, making a total for the year of 17·66.

AGRICULTURE IN BARBADOS.

The rainfall for August durng the past six years has not been less than 6 inches. This year on the black soils a little over 1½ inches is the record for the month, on the red soils 3½ inches The rainfall on these soils for the year is 21 inches and 29 inches, respectively.

Heavy soaking rains are now required. The ground is becoming dry and hard, and very little moisture is in the subsoil, and unless there is a sufficient rainfall this month, the crops will suffer greatly. Owing to the dry weather, all the ratoons have not yet received their second application of chemical manure, and those which received some, four weeks ago, have made very little progress, as they have not had rain enough to absorb it. The first and second ratoons are unfortunatelly breaking down in some places, particularly in St. George and St. Philip, and are getting diseased. Many sickly looking patches can now be seen in some fields.

This is due partly to over cropping and also to lack of sufficient farm-yard manure. The B.H. 10 (12) is withstanding the weather better than any other variety. The Ba. 6032 has developed in certain areas many yellow leaves and dry hearts

The manuring of cultivated fields is continuing, but planters are finding it difficult to make up the desired amount of farm-yard manure, owing to the lack of litter and bush. Sheep manure is now being obtained, but in limited quantities.

The fields in every parish which are for plant canes are being tilled rapidly, but very few leguminous plants fot green manuring are to be seen growing in them Unless fields have the necessary amount of nitrogen a full yield from crops cannot be expected.

The yam and eddo crops are growing well in the Leeward parishes, although they were planted late. Wood or megass ashes applied to them are beneficial to root crops.

Bitter cassava, from which flour and starch are obtained, is now scarce. It has been a great help to the labouring people during the past six months. More can be planted now.

Potatoes are still scarce and dear; 6c. and 7c. a lb are being asked for them and people are glad to get them. Breadfruit are now being sold at a very high rate in the city.

Fodder is still unobtainable in sufficient quantities, and old canetops are still being used It is hoped that the situation will soon be relieved. (The Barbados *Agricultural Reporter*, September 4, 1920.)

LEATHER SCRAP AS A MANURE.

Waste leather as a nitrogenous fertilizer has frequently been recomonended as a cheap manure in countries where this material is easily obtainable. Its chief disadvantage lies in the extreme slowness with which it decomposes in the soil. Recently it has been shown, however, (R. Gullin, *Bull. Soc. Agri.*, France, 1917) that chrome leather scrap actually decreases the rate of nitrate formation in calcareous soils, and consequently also, the crop yield. Tanned and burnt leathers were found not to be injurious, but to have little fertilizing value. When leather scrap is dissolved in sulphuric acid, the product is of very much greater value, and it has been shown that such 'dissolved leather ranks high as an organic fertilizer.

In connexion with the leather industry, it is worthy of note that recent attempts have been made to utilize as a fertilizer tanning waste, which is rich in phosphorus, potassium, and calcium. The chief difficulty has been with the tannic acid present in the waste. It has been found that this may be neutralized with lime, or removed by treatment with ferrous sulphate, so that another waste product of the leather industry now becomes available to agriculture.

The Geological and Mineralogical Surveyor in his special report attached to the Report of the Department of Agricultural Science states that, as the result of his examination of the Demerara River district, it is evident that the district possesses one of the largest and richest, as well as the most readily accessible deposits of bauxite in the world.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, August 19.

BALATA—Venezuelan Block, no quotations; West Indian Sheet, 4*s.* 3*d.* to 4*s.* 3½*d.* c.i.f., spot, 4*s.* 7½*d.*
BEESWAX—No quotations.
CACAO—Trinidad, and Grenada, 95*s.* St. Lucia, Dominica, and Jamaica, no quotations
COPRA—£53 10*s.*
HONEY—75*s.* to 105*s.*
LIME JUICE—Raw, No quotaions Concentrated, no quotations.
PIMENTO—4*d.*
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T. S. GARRAWAY & Co., September 14.

ARROWROOT—$8·00 per 100 lb. duty paid.
CACAO—Lottings at $17·00
COCO-NUTS—$65·00 husked nuts.
HAY—Sales at $6·00.
ONIONS—Lottings at $12·00.
PEAS, SPLIT—No quotations; Canada, $13·00 small, $15·00 large.
POTATOES—Sales at $16·00
SUGAR—Market bare.

London.—THE PERFUMERY AND ESSENTIAL OIL RECORD, July 20.

BAY OIL—30*s.* per lb. spot, and 28*s* forward.
LIME OIL—7*s.* 6*d.* for West Indian distilled, and for hand-pressed 25*s.* 6*d* per lb.
ORANGE OIL—West Indian, 40*s.*

Trinidad.—Messrs. GORDON, GRANT & Co., August 6.

CACAO—Venezuelan, $17·25 to $17·50.
Trinidad, $16·50 to $17·00.
COCO-NUT OIL—$1·45 per gallon.
COFFEE—Venezuelan, 20c. to 24c. per lb.
COPRA—8c. per lb.
DHAL—No quotations.
ONIONS—5c. per lb.
PEAS, SPLIT—$11·00 per 100 lb.
POTATOES—English, 11c. per lb.
RICE—Yellow, $14·50 White, No. quotations.
SUGAR—No quotations.

New York.—Messrs. HUTH, GILLESPIE & Co., Inc September 9.

CACAO—Caracas, 14½c. to 14½c.; Grenada, and Trinidad, 14¼c. to 14c.; Jamaica, 10c. to 11c.
COCO-NUTS—Jamaica selects, $55·00 per M; Trinidad 52$·00 per M; Jamaica, $40·00; Trinidad $35·00 per M. culs.
COPRA—7c.
COFFEE—Jamaica, 10½c. to 15c. per lb.
GINGER—34½c. to 38c. per lb.
GOAT SKINS—Jamaica, Antigua, Barbados, St. Thomas and St. Kitts 70c.
GRAPE FRUIT—Jamaica, $3·00 to $5·00 per box.
LIMES—$6·00 to $8.00 per bbl.
MACE—28c. to 30c.
NUTMEGS—18c. to 18½c.
ORANGES—$5·00c.
PIMENTO—7¾c. per lb.
SUGAR—Centrifugals, 96°, 10c.; Muscovados, 89°, 9c.; c. & f., Molasses, 89°, 9c.

Special Selected Sea Island Cotton Seed

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Colonial Development.

I.

IN July and September of 1919 two important Agricultural Congresses were held. The first of these was the French Agricultural Congress held in Paris from June 30 to July 3; the second was the National Congress for the Agricultural Restoration and Betterment of Rural Life in Belgium, which met at Brussels from September 28 to October 1. These Congresses discussed in great detail steps which must be taken to restore the serious damage wrought in the areas in Western Europe by the late war. The results of the deliberations will have far-reaching effects. A point which immediately concerns us is that consideration was given, particularly by the French Congress, to colonial agricultural development, and elaborate plans were made for organizing and fostering this development.

The need for colonial development now presses upon European nations, not merely from the point of view which formerly presented itself, and which has had some though inadequate attention, namely the necessity for so developing the colonies that they might be self-supporting, while contributing to the industrial needs of the mother lands, but mainly from consideration of the needs of the mother land, Great Britain, France, Belgium, Holland, as the case may be. There is marked shortage in the supply of many commodities which the colonies of these countries can and do supply—sugar, cotton, rice, rubber, oil seed, fibres, food grains, including rice, amongst the things that may be named; and it is vital to the interests of the mother lands, apart from the interests of the colonies themselves, that these things should be forthcoming in increasing quantities. Prices which may almost be described as famine prices are now being paid for some colonial and foreign products, such as sugar and cotton, and strenuous efforts are being made to increase their output, not in the interests of the colonies, but in the interests of the home countries.

From the programme suggested for the development of the French colonies, it would seem that the effort is to be well directed and organized. The following summary of this programme is given in the *Experiment Station Record* of the United States Department of Agriculture.

'At Paris advance ground was taken in connexion with the fostering of colonial agriculture. The Con-

gress recommended as a minimum programme the establishment of at least one permanent agricultural station for each distinct agricultural region in the colonies. These stations would each include sections of economic botany and plant introduction, plant propagation and distribution, plant diseases, and meteorological observations, a research section, and a section for field testing and demonstrations. Particular insistence was expressed on the necessity of adequate facilities, including laboratories, a library, a museum, and a competent and well-paid personnel, the opinion being expressed that in the past, insufficient support had been the most serious handicap to full efficiency.

'In addition it was proposed to supplement these general stations by a series of special research stations for the study of each of the colonial products, such as cotton, vanilla, rubber, sugar, coco-nuts, tea, silk and live stock. All these stations would be under the immediate supervision of a Bureau of Colonial Agriculture in the Ministry for the Colonies, which would act as a central clearing house of information on colonial agriculture.'

The proposal is a fine one, and it constitutes an excellent ideal at which to aim. There can be no doubt that the efforts in this direction, which must take years to realize, will be of marked benefit to the colonies and to the mother country. No such comprehensive scheme is in sight in respect to British interests, though some of the proposals have a familiar ring and have been, and are being, attempted in more detached manner in connexion with British colonies.

While much of the solicitude for colonial development may now be due to home needs, the accentuation of these needs has been of great, direct and immediate benefit to the colonies. To confine attention to the West Indian colonies, poverty, anxiety and struggle have given place to prosperity and efforts at expansion. Colonies and small communities which within quite recent years were struggling against difficulties and hard times, and were the despair of those responsible for their administration, are now flourishing, and their people abundantly employed. Their rapid recovery has been remarkable, and has been the cause of comment in many directions. This capacity for rapid recovery is deserving of a moment's thought; it may be claimed that it is not merely an indication of inherent vitality and resiliency possessed by these colonies, but that, in no inconsiderable degree, it is the outcome of considered measures, similar to those planned by the French Congress referred to, but carried out in these parts on a much smaller scale. It may be claimed that the capacity for development is the outcome of preparedness. For years past the West Indian communities have recognized the need for improvements and have struggled to obtain them; restricted resources and unremunerative industries hampered these efforts; but when the Mother Country furnished means for the better equipment of the work of investigation into agricultural matters. the colonies for the most part welcomed the effort. In this way, for many years past information regarding the possibilities of various industries has been accumulating. When opportunity arose, where developments could be made and improvements effected, there was a measure of preparedness in the communities, the full extent of which was hardly recognized by the communities themselves.

Several industries illustrate this. The sugar industry laboured for years under great disabilities, and at times it seemed doubtful whether it would be possible to overcome them. In various parts of the West Indies, however, attempts were being made to study the problems involved, so as to obtain means for their solution. In one or two instances opportunities arose for effecting improvements and making demonstrations in connexion with the industry, notably in the case of the central sugar factory at Gunthorpes in Antigua, which received some assistance from the Government, and which, in return, gave full publicity to its results. These results were noted and studied in other places, and contributed in no small degree to a spirit of preparedness, so that, as occasion served, other efforts were made in other places, and improvements were effected in connexion with the sugar factories of St. Kitts, Trinidad, Barbados, and other colonies. In consequence, there now exist in all these places, sugar factories of reasonable efficiency, whereby waste is saved and wealth is being accumulated, while incidentally, the needs of the home country are in some small measure contributed to.

Another case of rapid development, the outcome of preparedness, is afforded by the cotton industry. For some years agricultural departments and planters in the West Indies, assisted by the spinners in England, had been working together to understand the intricacies of the production of Sea Island cotton. The difficulties were great, and at times it seemed that they might be insuperable. Knowledge and skill were, however, accumulated, and when the need came for another source of supply to take the place of the

finest Sea Island cotton formerly obtained from limited regions in the United States, a British West Indian supply was available, and the situation was relieved. In this case great benefit accrued alike to the British West Indies and to the British industry.

Rice may be cited as an instance in which preparedness enabled an important industry to become efficient at a time when greatly needed. For years much patient work had been done by scientific investigators and by planters, and many discouragements overcome. Here again fears were often entertained that the difficulties might be insuperable; patient work, however, led to their being overcome, and rice growing now ranks as an important and steadily developing industry in British Guiana and Trinidad.

In other respects besides those noticed, it may be claimed that development and advancement have been influenced in no inconsiderable degree by planned investigations, such as it is anticipated should accrue from such proposals as those made by the French Congress. Work done under such auspices is bound to be remunerative, though the effects may be indirect and may appear to be slow.

AMERICAN POTASH SUPPLY.

The following paragraphs, drawing attention to important developments in the production of potash in the United States of America, are reproduced from an article in *The Times* Trade Supplement, July 10, 1920.

Part of an appropriation of $50,000,000 made by Congress for the development of American industries during war time was used in an effort to develop potash resources.

By 1918 production had risen to 55,000 tons, little enough in comparison with the nation's estimated need of 350,000 tons a year, but a good first step towards future independence of Germany in this commodity. When the war ended, however, American potash makers, alarmed at the prospect of competition from the German supply, very largely gave up production of the material. The 1919 production was only 20,000 tons, and it will be less this year. As the situation stands, if Germany can within the next few months reorganize her industries, she will soon be shipping potash in large quantities to the United States and, in an effort to regain her mastery of the market, will undoubtedly sell it as cheaply as possible.

There are several sources of potash on the American continent, one of the most important being situated close to New York City. At New Brunswick, New Jersey, there is in process of construction at present a $2,500,000 plant for the manufacture of potash from glauconite, or green sand, by a process which not only produces potash cheaply and efficiently, but also leaves a residue, high in lime content, valuable in agriculture, and even more so in the making of brick, tile, wall plaster and fire-proofing materials. The plant will cover 105 acres when completed, and will contain, among other things, what is said to be the largest lime-burning plant in the world.

Glauconite, one of the chief sources of potash in the United States, is found close to the surface in a narrow strip almost uninterruptedly through the States of New Jersey and Delaware. The Federal Bureau of Mines estimates that the supply in these two States would furnish potash for the United States for about 4,000 years. The plant under construction is expected to handle 1,000 tons of raw material daily, and to have an annual output of 30,000 to 40,000 tons of caustic potash (potassium hydroxide), the purest variety of potash salts. This will, in addition to 1,000,000 tons of the residue, be available for agricultural purposes or for building material.

Another important source of potash is a saline lake in San Bernardino, California, estimated to contain some millions of tons of potash, which can be dealt with by evaporation and separation from sodium salts and borax, with which it is found. Potash is also derived from a variety of seaweed known as giant kelp, that grows in great quantities on the Pacific coast. A Government experiment with this source is in progress, and is said to be successful, although the cost of manufacture is high, and transportation from the Pacific coast is a deterring factor, from the point of view of agriculture and industry in the East. The chief sources are, however, Searles Lake and the glauconite deposits, the second of which are nearer transportation centres, and easily and cheaply worked. These two offer a chance to become independent of Germany for all time in the matter of potash. Developed, they should protect the United States against any future European combination.

CONTINUOUS CLARIFICATION IN THE SUGAR FACTORY.

One of the chief objections to the usual process of clarification, as practised in the majority of sugar factories, is that it is not continuous, for the successive charges of heated juice, after being boiled up with lime to the 'cracking point', are allowed to remain undisturbed for a time, until the impurities have settled.

Recently a continuous method has been applied to the treatment of cane juice in Cuba. A special form of clarifier, known as the Dorr clarifier, is used. The following description of this apparatus is taken from the *Louisiana Planter*, September 11, 1920.

The Dorr clarifier is essentially a cylindrical apparatus, 18 or 20 feet in diameter, consisting of superimposed settling compartments, equipped with slowly revolving scraper mechanisms, and fed through a central loading-well, into which hot limed juice flows continuously. It is arranged so that the inflowing juice produces no appreciable disturbance of the liquor already in the compartments, with the result that the suspended and precipitated matters slowly settle, and are moved to the central outlet in the bottom of the apparatus, while the clear juice overflows through numerous pipes at the outer wall of the compartments. This juice has been found to be very much clearer and freer from suspended impurities than that ordinarily prepared in the older type of intermittent settling and decantation tanks.

The mud after removal is diluted with hot water, and filter-pressed, which removes from the diluted mud all of the solids in the form of a dense cake, while nearly all of the sugar is retained in the press water.

The advantages of this process lie in the greater cleanliness of the sugars produced, the greater economy of time, labour, and fuel, and the smaller loss of sugar, all of which, in the aggregate, means the saving of very large amounts of money.

THE PARTIAL STERILIZATION OF SOILS.

Dr. E. J. Russell, the Director of the Rothamsted Experimental Station, England, has recently read a paper before the Royal Horticultural Society, in which he described briefly the line of work now being followed at Rothamsted in connexion with the effects of partial sterilization on the growth conditions of soils.

Recent investigations have shown that the upper layer of most British soils contains an abundant population of micro-organisms of various kinds. Among them are bacteria, amoebae, flagellates and fungi. In addition, eelworms (nematodes), wireworms (the larvae of the click beetle), ants and earthworms also occur. All these forms of life depend primarily on the plant for their food; some live on the growing plant and are either beneficial, or more frequently, harmful to it; others live on the dead remains of plants and convert them into simpler substances, of which many are absorbed by the growing plant as food material. It frequently happens with soils which have long been in use in horticultural and intensive cultivation that harmful soil organisms become so abundant that the soils are no longer capable of producing normal yields. Such soils have been described as 'sick' soils. They are of common occurrence in hot houses and conservatories, and are not unknown in the field.

Many attempts have been made to control the soil population with a view to improving the conditions for plant growth. Two methods of investigation are possible. First, the soil population may be examined and its composition determined. Then it may be found which organisms are beneficial and which harmful to plant life by the application of pot culture methods. Finally, methods of exterminating the harmful types and encouraging the beneficial types can be found, so that 'sick' soils may be treated in order to bring about their improvement. The second method lies in the use of agents which kill certain soil organisms but not others. Many years ago the beneficial effects of heating soil on its productivity was discovered. It led to the old practice of paring and burning. Doubtless this process owes its efficacy to the fact that the heating kills many of the harmful organisms which had previously inhibited the proper growth of crops. Perhaps, also, it increases the supply of nitrogenous compounds available for plant nutrition.

It is found to be unremunerative to apply the method of partial sterilization by heating the soils of the farm, but in the case of intensive cultivation in market gardens, and under glass, the method is frequently of great value, especially when applied to sick soils which contain large numbers of disease organisms. Numerous experiments carried out with tomatoes grown in sick soils showed that an increase in yield followed on the partial sterilization of the soil by heating with steam pipes, and by treating with antiseptics, such as toluene or carbon bisulphide. Steam proved to be so effective that it would invariably be used if questions of cost and convenience could be ignored. It not only kills animal pests, but also eggs and larvae of eelworms, wireworms, wood-lice, spores of fungi and many protozoa. Further, it brings about a certain amount of decomposition, and thus facilitates the work of useful soil bacteria.

The cost involved in heating soils to bring about partial sterilization, even under the most favourable conditions, will always prohibit the extensive application of the method as an agricultural operation. Hence chemical methods, which are much more convenient and economical, will have to be evolved if any practical use is to be made of the positive results that have been obtained from laboratory experiments on the partial sterilization of soils.

Many attempts have already been made to find suitable chemical sterilizing agents. At the outset a difficulty arises in the use of such substances, in that the compound applied to a soil to effect partial sterilization may persist therein and prove to be poisonous to the crop which is subsequently grown on that soil. At Rothamsted, volatile antiseptics were tried in the earlier experiments, because they readily evaporate from the soil and present no danger of adverse after effects. Toluene and carbon bisulphide were the two volatile antiseptics chiefly employed. A drawback to their use, however, exists in their dangerous inflammability. This involves the exercise of caution in handling and carriage, and thus increases the cost of the sterilization process. Furthermore, toluene is liable to fail in moist soils, since it does not mix with water, and so cannot penetrate into moist soils.

Later trials were made with cresylic acid, which is a common derivative of coal tar, and which during the war was sold at 2*s*. a gallon under the name of 'liquid carbolic acid'. Cresylic acid, although not a volatile substance, readily disappears from soil because certain soil bacteria bring about its oxidation with the formation of harmless products. After a short period, therefore, crops can be grown on the treated soil without fear. Cresylic acid was applied, diluted with water to the extent of 40 gallons of water to 1 gallon of acid. This amount of the mixture served to treat 9 to 18 square yards of soil. The soil was afterwards heavily watered, and was in a condition to receive plants after an interval of a fortnight. The cost per acre, with the price of cresylic acid at its post-war figure of 4*s*. per gallon, works out at £105. Half strength may be used with advantage, and the cost may thus be reduced to £52 10*s*. per acre. Cresylic acid, however, proves to be less efficient than steam heating in the partial sterilization of soils. It is also less reliable, and one can not always be certain of obtaining beneficial results from its use

It would appear that a further search for suitable chemicals with which to treat soils in order to improve their conditions for plant growth, should be made along specific lines. The effect of different compounds on these soil organisms which are known definitely to be responsible for certain diseases of plants should be studied, and lists drawn up of those substances which prove to be poisonous to the several types. A substance may prove fatal to one kind of organism, but not to another, and may, therefore, be used as a specific remedy.

Already much information has been accumulated, but the method of experimentation is very slow, even though it possesses the merit of certainty. Much yet remains to be done along the lines of work already mentioned, and it is probable that many papers on the subject will appear in agricultural publications in the near future. The detailed results of the Rothamsted experiments on soil sterilization are expected soon to appear, for Dr. Russell's paper may be taken as a forerunner of the results already obtained under his direction.

A certain number of facts have so far been stated in connexion with the employment of chemical compounds for bringing about beneficial partial soil sterilization, and it

may be of interest now to consider a few typical cases, briefly described by Dr. Russell in the paper under review. Organic nitro-compounds are of especial interest, as they happen to be available in large quantities at the present time Picric acid, extensively used as a high explosive during the war, is one of the commonest of this class, and investigations show that, although at first very injurious to plants, it gives rise to harmless compounds in the soil, in addition to nitrates which are largely beneficial to plants Picric acid rapidly destroys eelworms and fungus spores, and is a useful antiseptic for partial sterilization of soils

A compound, related to picric acid, namely chlorpicrin, which is also an explosive, has recently been supplied by the Chemical Warfare Department for trial at Rothamsted. This compound proved to be of exceptional value as a partial sterilizing agent. It has the great advantage, unlike picric acid, of being harmless to plants. It is fatal to eelworm and wireworm, and is said also to promote root growth. It is cheap at present, but unfortunately it is dangerous to handle. When being spread on soil, the spreaders must wear masks.

Many compounds, other than organic nitro-compounds, have also been tried. Calcium sulphide is noteworthy amongst these because, in addition to being an effective sterilizer, it gives rise to valuable calcium carbonate in the soil. Sodium cyanide also is effective against eelworms, but it has little fungicidal activity. In the soil it finally breaks down into sodium formate and ammonia. Both these decomposition products are beneficial, for the former, being a weak alkali, tends to correct soil acidity and the latter is a valuable plant nutrient.

In conclusion, the bearing on West Indian agriculture of the facts so far discovered in connexion with the use of agents for the partial sterilization of soils, may now be considered. Steam heating may be dismissed for reasons already mentioned. It would be quite impracticable, and far too expensive for application to any of the common West Indian crops.

Chemical agents, on the other hand, suggest many possibilities. At least one important West Indian plant disease, namely, the Red Ring or Root disease of coco-nut palms, has been shown to be due to a nematode related to the common eelworm of Europe. (See *West Indian Bulletin*, Vol. XVII, No. 4, p. 189.) It is possible that this disease is passed on to young coco nut trees from the soil and previous treatment of the soil with some chemical sterilizing agent known to be effective against nematodes, may thereforebe expected to reduce the likelihood of infection.

Doubtless many other harmful micro-organisms in West Indian soils could be eradicated by use of suitable chemical sterilizing agents, and an increase in crop production thereby ensured. Finally, it appears reasonable to suppose that certain chemical sterilizing agents capable of destroying the larvae of root-boring insect pests, such as are known to do considerable damage to West Indian crops, might in due course be discovered. The use of some chemical sterilizers would greatly improve the conditions of cultivation in many regions of the West Indies. The cane crop frequently suffers considerable damage from attacks of the root borer (*Diaprepes abbreviatus*), and root crops, such as the sweet potato, are continuously threatened with destruction owing to insect pests the eggs and larvae of which occur normally in the soil.

It would therefore be of considerable economic value were a series of experiments to be inaugurated whereby the efficiency of certain chemical sterilizing agents could be tested with a view to improving the conditions of growth of West Indian crops. F.H.

THE PREVENTION OF SUGAR DETERIORATION.

An article by Dr. N. Kopeloff, of the Louisiana Sugar Experiment Station, on a method of preventing the deterioration of sugar during storage, appears in the *Journal of Industrial and Engineering Chemistry*, September 1920.

Sugar deterioration has long been known to be due to the activities of certain micro-organisms, belonging chiefly to the group of fungi known as moulds The spores of these fungi, together with species of bacteria, gain access to sugar products from the air and, under favourable conditions, grow into the fungus mycelia and colonies, which produce decomposition of the sugar upon which they feed Any means whereby the number of spores and bacteria present on sugar or sugar products can be reduced, will minimise the amount of decomposition. Especially prone to attacks of fungi and bacteria are molasses, and stored massecuites and syrups. Indeed, freshly discharged massecuites also are likely to take up innumerable fungus spores and bacteria soon after they have cooled.

A method of destroying the micro-organisms in massecuites before they are put into the centrifugals, is the subject of the article above mentioned Super-heated steam was the agent used in destroying the micro-organisms. Jets of super-heated steam were caused to impinge inside and outside the basket of an experimental centrifugal machine set up in the laboratory. A sample of crystal sugar heavily inoculated with a coating of molasses, containing spores of fungi and bacteria of species such as are known commonly to produce deterioration of Cuban sugars, was placed in the centrifugal, and then subjected to the action of super-heated steam whilst it was being rotated. Subsequent examination of the sugar showed that about 98·5 per cent. of the micro-organisms had been destroyed Molasses similarly treated, lost about 84 per cent. of its bacterial population, and 50 per cent. of its content of fungus spores.

This result suggests a substitute for wash water, such as is frequently employed to remove traces of molasses from sugar during centrifuging.

With proper handling of sugar under sanitary conditions together with minimum possibility of the sugar absorbing water during storage, it would appear that treatment with super-heated steam in the centrifuging of sugars will completely prevent deterioration due to the activities of micro-organims.

The gift of £10,000 which Mr. John Q. Rowett, of Ely Place, Sussex, has given for the establishment of an institute at Craibstone, Aberdeen, for research work in animal nutrition, has every prospect of proving one of the most valuable gifts ever made for agricultural research. The feeding and management of farm live stock affords a wide field for important investigation, and the significance of the question affected will increase as the necessity for practising economy presses with increasing weight upon farmers. The future of the industry, it is believed, will be as closely bound up with animal husbandry as its recent past was, and with costs advancing alarmingly, it is plain that every possible form of economy will have to be observed in order to make ends meet. Mr. Rowett has made a wise and valuable donation for the development of a branch of research of far-reaching importance. (*The Field*, August 7, 1920.)

SUGAR-CANE BLIGHT IN TRINIDAD.

The following, reproduced from the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XIX, Part I, as being of interest to sugar-cane growers in general, is a summary of the conclusions, arrived at by Messrs. W. Nowell, D.I.C., and C. B. Williams, M.A., F.E.S., after their investigations on the above subject in Trinidad.

I The Froghopper.

1. An infestation of froghoppers can produce a definite form of blight without necessary co-operation of other insect or fungus agencies.

2. The characters of the condition so produced consist of:—

(*a*) Leaf injury, beginning with the formation of elongated spots and patches, pale at first, then red brown, and finally dry and silvery brown; which injury in well-developed infestations results in the premature withering of most or all of the leaves.

(*b*) The more or less complete arrest of growth, in which the well-developed canes in a stool suffer little, the youngest shoots die outright, and the shoots of intermediate age are affected in inverse proportion to their size. (It follows from this that the better the canes are developed the greater is their resisting power.)

3. This condition differs, in plainly recognizable characters, from that produced by any form of root disease known to the writers.

4. (*a*) In some cases the appearances produced agree very closely with those described for the Sereh disease of Java, but the subsequent history of the stools shows that the resemblance is one of appearance only, the continued degeneration in successive years characteristic of Sereh being entirely absent.

(*b*) Nothing has been seen to suggest that the Mottling or Mosaic disease, now giving trouble in Porto Rico and Louisiana, is involved in the production of blight.

5. The general condition described seems to be mainly the result of injury to the leaves, as appears both from the observation of attacks and from consideration of the symptoms of the affected stools. This conclusion is supported by the following evidence:—

(*a*) The condition reaches its most acute phase shortly after the chief flights of adult froghoppers.

(*b*) Where there is no complication with root disease or hindrance by drought, the stools even in the case of low ratoons in which all or nearly all the shoots are killed to the ground, resume vigorous growth when the brood of froghoppers has passed.

(*c*) The root system and underground stem system in these uncomplicated cases do not appear on examination to be seriously affected.

6. In the present year (1919), which is one in which the froghopper is near its minimum, the third brood infestations can be classified as follows:—

(*a*) A belt of infestation in the Naparimas which coincides closely with the occurrence, in bands and patches, of a particular type of red clay soil.

(*b*) An area of several acres in the Northern sugar district in which the soil, a fine silt, is closely compacted and probably sour.

(*c*) Scattered small patches, mostly with no immediately recognizable defect in conditions, but strictly local, frequently distinctly related to the contour of the ground, and surrounded by large areas of healthy cultivation.

7. These infestations are of a type approaching in local numbers and severity the more widespread infestations of maximum froghopper years.

8. Froghoppers are very lightly distributed through the unaffected fields, therefore the damage does not arise from the locally accentuated action of insects generally distributed, but from the development of the insects in large numbers where the local conditions of a field or patch especially favour it.

9. In some cases the patches of infestation and damage are sharply defined from the rest of the crop in the same field.

10. From consideration of the effects of difference of rainfall in certain periods and certain districts, and from local observations of soil and seepage effects, it appears most probable that the conditions governing the development of froghopper infestation arise in some way not understood from a soil and moisture relation.

11. A merely backward or stunted condition of the crop is not in itself sufficient to induce a froghopper infestation. There are very many such fields this year which are quite free from blight.

II. Root Disease.

12. The fungi capable of causing root disease of sugar cane at present known in Trinidad belong to the genera Marasmius and Odontia.

13. They occur to some extent in all cane fields, but vary very greatly in quantity and development in different fields and at different seasons

14. Under conditions favourable to the cane they can be present in notable quantity without any visible ill effects, existing on dead or dying material only.

15 Root disease is brought about when for any reason these fungi are enabled to attack parts of the living plant.

16. Any factor adversely affecting the vigour of the cane may decrease its resistance sufficiently to allow of the development of root disease.

17. The common type of root disease consists of the invasion and destruction of the roots. Its effects are difficult to distinguish from the direct effects of defective aeration or poverty of soil.

18. There is a much rarer and much more severe type, due as it appears to certain species of Marasmius, in which the base of the stem is killed for several joints, the death of the whole cane following in consequence.

19. There is a field of first ratoons at present under observation attacked by this severer form of the disease when the canes were already well-grown and large, which seems likely to be practically destroyed. In this case there was distinct injury to the leaves by froghoppers in August, and again in October. The field would be known locally as blighted, but the real cause of the injury, as shown by its nature, is the root fungus infestation.

20. It now appears that the prevalence of root disease over wide areas in Trinidad late in the season, reported on last year by one of us (W.N.), is largely due to the weakening of resistance by previous attacks of froghopper.

21. The effect of root disease accompanying or following froghopper injury is to increase its effects and to prevent recovery, making the blighted condition permanent.

III. Control.

22. No direct method for control of the froghopper is at present in sight. Natural enemies, especially the fungus diseases of the adults, exercise a considerable measure of control under favourable conditions.

23. Root disease can be controlled by reducing the ratooning period, by improving preparation, cultivation and drainage, by the use of organic manures and of lime, and by rotation of crops.

24. The general evidence goes to show that it is in the fields which have had least attention in these matters, and in fields naturally poor that the froghopper finds the most suitable conditions for rapid multiplication.

25. The admitted exceptions occurring in froghopper years, in which some good fields may be attacked, may very well be due to migrations of the pest from fields in worse condition.

26. The practice of throwing out fields to grass, especially when the old stools are left to sprout, is definitely bad with reference to both froghopper and root disease (as well as all other insect and fungus diseases of cane).

27. It should be an invariable rule to plough out as soon as possible stools not intended to be cultivated as rateons. It is highly desirable that in addition to this, a cultivated crop not belonging to the grass family should be grown.

28 It is our conclusion that well-considered application of the measures referred to in paragraph 23 will give the best protection available against the development of froghopper infestation, will greatly reduce the direct effects of such an infestation when it occurs, and will remove the serious contribution now made by root disease to the final condition of blighted fields.

NICOTINE IN TOBACCO.

The reason why certain plants produce and store up compounds of a poisonous nature is very difficult to discover. The old theory that such plants manufactured poisonous substances in order to serve in protecting them against possible injury by browsing animals, presupposes that their evolution followed a definite plan of which the aim was to produced such adaptation.. Teleological explanations, however, are nowadays largely discountenanced, and some other reason must be found to meet the case.

According to Darwin's theory of evolution, plants producing poisonous substances arise because of the continued existence of those individuals of any one generation of a genus of plants, which happen to possess an abnormal amount of the poisonous principle, so that these individuals tend to survive in the struggle for existence. In any one generation, the poison content of the individual plants thus comes to exceed that of plants of the previous generation, and this process of natural selection eventually ends in the production a strain in which the percentage of poisonous substance is very high.

Since the time when Darwin's theory of evolution was propounded, increasing attention has been paid to the importance of the natural production of mutations [or 'sports,', in order to explain the evolution of distinct species of plants and animals. Apparently at any time an abnormal individual may arise in any generation. The reasons for the sudden production of abnormalities are very obscure, but the fact that they can and do arise is well known. For example, the double rose suddenly appeared in a genus which had previously only exhibited a simple type of floral structure. By vegetative means, this double rose plant was artificially propagated and eventually established.

It seems probable, therefore that poisonous plants were produced in a similar way. The nature of the poisonous substance which characterizes such plants is perhaps quite immaterial from the view point of the plant itself, and in any case it may be simply a waste product of metabolism which is deposited within the plant tissues. Undoubtedly the plant benefits to some extent by the presence of the poison, for animals learn by experience to avoid noxious herbs, which therefore are allowed a greater possibiiity of establishing themselves in any particular habitat.

The recent work of L. Bernardini, referred to in a recent number of *Chemical Abstracts*, has thrown new light on the rôle played by poisonous substances present in certain plants. His studies of the tobacco plant (*Nicotiana tabacum*) have shown that nicotine, although poisonous to the seeds, is not poisonous to the tissues of the leaves, stems, and roots of the plant. During the growth of the tobacco plant, nicotine appears in the leavesof the young plant even before they turn green. In matureplants, the greatest amount of nicotine is found in the growing regions. It further appears that nicotine cannot be utilized by the tobacco plant as a food material even under conditions of starvation. These results suggest that nicotine serves the purpose of impeding the accumulation of nitrogenous waste products or residues which might be toxic to the plant tissues. Any excess of nitrogen which has to be excreted is incorporated within the molecules of nicotine, and causes no damage to be done to the plant.

MOLASSES AS A FUEL.

The investigations of G. E. C. von Stietz into the possibilities of using molasses as a fuel in sugar factories have been described in *Arch: Suikerind*: 28, 1920. The main results are summarized in *Chemical Abstracts*, August 1920, and are briefly as follows.

The burning of molasses mixed with megass does not give good results because of the formation of a slag which chokes the furnace grates and prevents proper combustion. The potassium compounds present in the molasses moreover, exist in an insoluble form in this slag so that its value as a fertilizer is greatly reduced. If molasses is burnt alone, much furnace space must be provided because of the large amount of foam produced, and the great bulk of carbon liberated.

The only way to use molasses by itself as a fuel is to preheat it so as to bring about carbonization. A process is now being perfected in which the burning can be so regulated that either a dry char containing about 40 per cent. of ash, or a pure white ash is left. The ash amounts to 7 to 12 per cent. of the molasses. It is soluble in water to the extent of 15 to 30 per cent and contains 30 to 50 per cent. of potassium oxide. The chief soluble potassium compounds actually present in it are the carbonate, the sulphate, the chloride and the silicate. It would be a diffcult matter to separate these compounds by fractional crystallization because their solubilities are so nearly alike. Various methods, however, have been devised for their isolation and purification in chemical plants worked in conjunction with large sugar factories. Only 20 per cent. of the heat produced by burning molasses is needed in the manufacture of the potassium salts, the remaining heat being available for utilization in the sugar factory.

Besides potassium compounds, the ash of burnt molasses contains compounds of calcium, magnesium, iron, and sodium. These include chlorides, phosphates and silicates of the metals named. A part of the potassium compounds, and all of the compounds of calcium and magnesium, and also silica are quite insoluble.

The increasing importance of preventing all possible waste in the modern sugar factory should be a sufficient reason to cause sugar technologists to give serious attention to the results of investigations such as the above, and it is hoped that some method of utilizing molasses in the way suggested will eventually be adopted in many of our large West Indian sugar factories.

F. H.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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NOTES AND COMMENTS.

Contents of present issue.

The present need for colonial development, and the importance thereof to the several mother countries, form the subject of the editorial of this number.

An interesting and instructive article on the partial sterilization of soils, with special reference to the bearing on West Indian agriculture of the facts therein disclosed, will be found on page 308.

On page 310 is reproduced a summary of the conclusions arrived at by Messrs. Nowell and Williams after their investigations on the sugar-cane blight in Trinidad.

A portion of a report by the Superintendent of Field Experiments, Trinidad, on implemental tillage conducted at St Augustine Experiment Station in 1919, is reproduced on pages 318 and 319.

Heat Injury to Plants.

The July number of *Phytopathology* draws attention to a source of injury to young crops which may be more prevalent in the West Indies than is usually supposed. It was noticed that the stems of beans in Colorado had collapsed at a point just at or below the surface of the ground. It appears that the excessive heat at the surface of the soil was responsible; the temperature of the soil was found to be over 100° F.

West Indian observations on this point would be of considerable interest: it would be useful to know whether instances have been observed where young seedlings, such as those of beans, cotton, corn or other crops have been observed to collapse as the result of high soil temperatures.

Boll-Weevil Danger in Porto Rico.

A note was published in the *Agricultural News*, July 10, 1920, from information received from the Commissioner of Agriculture and Labour, Porto Rico, concerning the accidental introduction into that island in January this year of Sea Island cotton seed infested with boll-weevil, from the Sea Islands viâ New York. The situation thus created is being very carefully watched by the authorities in Port Rico.

Further information has been received at this Office from the Assistant Commissioner of Agriculture and Labour, Porto Rico, to the effect that up to the time of his writing (September 11) the boll-weevil had not made its appearance in any of the plantations where the infested seed had been planted, nevertheless, investigations were still being carried on in this connexion.

The Influence of Partial Sterilization upon the Bacteriological Flora of the Soil.

In connexion with this subject which is treated at some length in other pages of the present issue of this Journal, interesting figures of a definite experiments in which the bacterial effect of calcium sulphide and of dichlorocresol were studied, have recently been published in *Compt: Rend*: 170, 1920. Truffant and Rezssonoff carried out these experiments and found that either of these compounds diminishes the bacteria by 75 to 80 per cent. of the original content during the first twelve hours after application. At the end of eight days the number rises to six or eight times that appearing in the untreated soil, again diminishing after the twelfth day, depending somewhat on the method of treatment. While the return to normal is gradual, it never quite reaches the former figure. A treated soil examined a year later showed 15½ million bacteria per gram of soil as against ₱4 million of the untreated soil. It was noted that 45 per cent. of the total bacteria present in sterilized soil was *Bacillus butyrinus*, while only 10 per cent. was present in the same quantity of untreated soil, lending support to the theory that the anaerobic bacteria predominate in the soil flora.

The Newer Knowledge of Plant Nutrition.

In an article which appeared in the previous number of the *Agricultural News*, attention was drawn to the need of plants for growth accessory substances. Dr. E. J. Allen, D.Sc., F.R.S., Director of the Marine Biological Laboratory at Plymouth, who will be remembered by many in Antigua, has recently pointed out that the microscopic plants which constitute an important part of the plankton of the sea, from which many food and other fishes derive their sustenance, have similar needs. His experiments indicate that in the absence of certain organic substances, which are normally present in sea-water, the diatoms of the plankton fail to develop normally.

The Distribution of Maize in the United States.

The *Journal of Ecology*, June 1920, contains a summary of Waller's paper on 'Crop Centres of the United States.' It is pointed out that maize, the 'premier cereal' of the United States, is in origin a tropical or sub-tropical plant which natives were cultivating when the Spaniards first arrived in the West Indies and Central America. It early showed great variability, and now has a large number of varieties and strains, many of which flourish far outside the climate of the original ancestor. Some indeed can be grown along the upper Missouri in a dry climate with a very long cold winter, and others will ripen seed even in the cool damp summers of the British Isles. This adaptability enables the plant to be cultivated with success all over the eastern half of the United States; instead of, as might be expected, its chief centre being in the warm and damp south-east, bordering on the gulf of Mexico. The cultivation there is scattered, owing to competition of crops which are confined to that region, and which give a higher economic return—notably cotton, and to some extent sugar, rice and tobacco. The 'corn belt' is much farther north, just south of the great lakes. The densest cultivation is in eastern Illinois and adjacent Indiana, and this is due to the 'black soil' prairie, a soil built on the remains of the post-glacial lake which was left on the retreat of the continental ice-sheet.

Sugar Industry in Venezuela.

The issue for September 4, 1920, of *Facts About Sugar*, contains an interesting account of the rapid growth in the sugar industry of Venezuela under the stimulus of high prices. The following extract from the article is worthy of attention. The principal sugar region of Venezuela is in the district of Maracaibo, near the southern end of the lake of that name, in the State of Lulia. There are located three central factories, of which the largest is the Central Venezuela. This factory deals with sugar-cane from 6,000 acres of land, to which have been added 1,200 acres for the coming season.

The grinding of the cane crop for 1919-20 was completed on June 4 of this year, during which time 120,112 tons of cane were transformed into 20,074,700lb. of centrifugal sugar, all of which was exported to the United States of America. The next crop (1920-21), on which grinding will begin September 1, is calculated to produce at least 30,000,000 lb.

The Central operates with the most modern machinery Its railroad is equipped with 304 cane cars, 8 freight cars of 15 tons capacity, and 3 locomotives. The company's pier, 160 meters in length, is now being enlarged to 215 meters. There is a storage tank for molasses, with a capacity of 500,000 gallons. In addition to the mill buildings, there are four buildings which house the employees, and also contain a laboratory and a hospital, the latter with a capacity of seventy patients. The company has been shipping sugar by steamer and schooners to Curaçao, where it is transhipped to New York on larger steamers.

The Sunflower as a Fodder Crop.

The nutritive value of the sunflower seed (really a fruit, and known botanically as an achene) has long been known. During the war, considerable interest was aroused in various countries as to the possibilities of growing sunflowers for food on a large scale. Not much advance was made, however, at least within the British Empire. The recent publication of the results of trials made with the sunflower plant as a source of silage for feeding stock is therefore not without interest. In the *Quarterly Bulletin* of the Michigan Agricultural College Experiment Station for May 1920, there appears an article on sunflower silage. The following notes are abstracts from this article.

Many Michigan farmers have during the past two or three years been growing sunflowers with corn for silage, and have been well satisfied with the results. They claim that the yield was considerably increased and the feeding value not impaired. It seems not to be advantageous, however, to allow the sunflower to occupy more than one-third of the total bulk of the green stuff.

The sunflower stands drought much better than corn, and yields about 20 per cent. greater tonnage per acre than corn.

Sunflower silage is dark-coloured, and is not a fodder for stock if fed alone. Sunflower silage and corn silage fed together in equal amounts gave very good results, and may be strongly recommended for the dairy herd.

It is possible that similar results to those obtained in Michigan may follow under West Indian conditions, and that sunflower and corn silage may prove of value as a fodder on estates in districts where dry sandy soils occur.

INSECT NOTES.

THE STABLE-FLY.

The recently published *Farmers' Bulletin*, 1097, of the United States Department of Agriculture, deals with the common pest of live stock, the stable-fly (*Stomoxys calcitrans, L*). This insect may cause considerable losses among farm stock merely by worrying, and loss of blood, and it is also the carrier of diseases, such as anthrax. Moreover, the stable-fly is important as an annoyer of man, and those is considerable evidence that it is concerned with the transmission of certain diseases of man, notably infantile paralysis.

The campaign against the stable-fly should, therefore be just as vigorous as that against the common house-fly.

Destruction of the maggots and prevention of breeding are most important steps in control. Heaps of straw and manure are the breeding grounds for flies. All straw used for feed or bedding should be stacked under dry conditions, and the remainder should be burned and scattered. Proper treatment of all animal refuse is essential. Manure should be hauled out and scattered at regular intervals, preferably every three days, and any accumulations of straw or hay especially adjacent to stables, should be disposed of.

Manure boxes with traps to catch the flies which breed out may be used on small farms.

The bulletin described, in addition, a trap which has been devised for catching the mature flies, and which has been found most successful. The trap is built in a frame so as to fit closely in a window, preferably on the brightest side of the barn, and close to the horses or cows kept within. The other windows are darkened, so as not to interfere with ventilation. The trap is described as follows.

At the bottom of the trap a space about $\frac{1}{4}$ inch wide running entirely across the window is left on both sides of the frame. This crack admits the flies beneath a roof or ridge of screen wire, having holes large enough for flies to go through, punched along its top at 2-inch intervals. To capture the house fly, bait consisting of any material attractive to them is placed in pans beneath this ridge. The flies enter this space, ascend through the holes, and are unable to escape. The sides of the trap, also, are made of ordinary screen wire bent inward and upwards in two horizontal folds running across the window, one toward the bottom and one toward the top. The ends of the screen are then securely tacked and a series of small holes punched along the inner edge of each of the folds. The flies, in trying to go in and out through the window, crawl into the folds and enter the holes at the apex, but never escape, as on the inside the holes are along the projecting ridge. Professor Hodge states that a trap set in a window in a basement barn near a cow within, caught nearly 5 quarts of flies from July 1 to November 1. The stable-fly constituted 90 per cent. of these flies.

LIQUID HYDROCYANIC ACID AS A FUMIGATOR FOR CITRUS TREES.

A recent bulletin of the Agricultural Experiment Station at Berkeley, California (*Bulletin* 308, June 1919), gives an account of the fumigation of citrus trees as carried out on an extensive commercial scale in California by the use of liquid hydrocyanic acid, H.C.N.

The highly poisonous nature of this compound is well known, and it is interesting to note that methods of using it in practical arboriculture without harmful effects on the operators have been evolved. Hydrocyanic acid gas, used in a sufficiently diluted state, is intensely destructive to insect life, especially to scale insects and beetles. The liquid acid, however, quickly scorches foliage and fruits, and cannot therefore but be used as a spray. In some of the early tests of 1886, a generator of hydrocyanic acid gas was used to pump the gas into a tent which covered the tree to be fumigated. Later, earthenware pots in which the gas was generated, were placed inside the tent, and gave more satisfactory results. In 1914, however, the outside generator was again adopted, but in a very much improved form. At first sodium cyanide was used in the generators to produce the gas, but, recently liquid hydrocyanic acid has been employed. The liquid acid is manufactured in a large central plant and then transported to the field in proper containers. There it is transferred to atomizing machines of a capacity of $2\frac{1}{2}$ gallons. The machines are operated by hand. A pumping device forces the liquid acid out of spray nozzles, when evaporation immediately occurs. The gas is blown into tents completely surrounding the tree which is being fumigated. With reasonable care there is little danger of an escape of the gas occurring, and the fact that hydrocyanic acid has been readily accepted by fumigators during the first year of its commercial production, speaks well for the efficiency of the control that can be exercised over it.

DOWN THE ISLANDS

ITEMS OF LOCAL INTEREST.

BRITISH VIRGIN ISLANDS. In his notes of interest for August, which have just come to hand, the Curator, Mr. C. A. Gomez, states that during the month the cotton plots at the Experiment Station, and the $5\frac{1}{2}$ acres put under cotton in July at the Botanic Station, Tortola, were weeded and kept in a clean condition. Of the four types of cotton planted, the one grown from Montserrat seed appears, so far, to be the best as a drought resister. On the whole, however, the plots are in urgent need of rain, and it is feared that, possibly, there will be no cotton produced for a first picking on some of them. The planting of Guinea corn and different varieties of sweet potato was continued, but the dry weather hindered the laying out of new experimental plots. On this account also, the abandonment of transplanting lime seedlings in the nurseries was necessitated, and the onions sown from American seed gave poor results. The planting out of the vegetable garden was postponed until more favourable weather occurs. The preparation of land for onion cultivation however, was commenced. With regard to the cotton crop, Mr. Gomez states that owing to unfavourable weather, the growth of the cotton plants was greatly retarded, and, on the

whole, there is little or no promise of any cotton being produced for a first picking this year In West End district, Tortola, and in Virgin Gorda, a fair crop of cotton is being reaped from ratoons in some fields There are many fields which still remain to be planted, and cotton growers are determined to try planting in September, in spite of the trouble and expense likely to be incurred in clearing and preparing the land. Ground provisions are very scarce. A good crop of mangoes was reaped, and a ready market at high prices found for them in the neighbouring island of St. Thomas. No serious outbreak of pest of any crop was reported during the month. The rainfall for the month was 3·24 inches.

AGRICULTURE IN BARBADOS.

September opened nicely, and the weather for this month has been, so far, excellent. Up to the time of writing, the rain gauge register discloses the fact that rain has fallen every day for the month, except on the 4th instant. On all the other days there have been some fine showers, which the earth has readily absorbed. The rainfall recorded in the red soil districts is already $5\frac{3}{4}$ inches for the month; in the black soils, over 3 inches. The rainfall for the year in these areas is 34 inches and 24 inches, respectively.

On September 12, strong winds caused some damage to vegetables and canes. In some places banana trees were uprooted, and cornfields laid low. Some forward fields of plant canes were blown down.

The cablegrams reported a disturbance passing close to St. Lucia. Many people on account of previous storm warnings, were very excited that day, and were expecting adverse weather, which did not occur.

Planters are progressing well with the cultivation of their fields for planting this year, and the plough can now move easily through any field Cane hole digging is also being continued and some estates are quite forward with their work. It may be noticed that many fields are now being pulverised, and sheep manure in large quantities supplied where there will hardly be any possibility of applying any farmyard manure. No effort should be spared in effecting a thorough cultivation of the fields, and more attention should be paid to the draining of them, wherever it is possible for it to be done.

Drainage renders a higher proportion of the annual rainfall available for the crop; consequently, drained land will suffer less from drought than the same land in an undrained condition.

Pens of farmyard manure are also being rapidly distributed to fields prepared, and fresh pens are being rapidly forced, in order that the manuring of the fields may be completed before the canes are planted. It is with some difficulty, however, that the material for making this pen manure is obtained, and some planters will have to resort to other fertilizers. Sheep manure is being secured as fast as a ship load arrives. This is scarce now, and in great demand.

The final application of sulphate of ammonia has not yet been given to fields. However, the cane crops are responding nicely to the rains which have recently fallen.

The ratoons are developing nicely in some places, and with favourable weather will still do well. The B. 6450, is holding out well, and there can be seen some fine fields of first ratoons. The B. H. 10 (12), the favourite cane, continues to grow well; there may be seen fine fields of Ba 6032 plant canes here and there.

The return of the Vegetables Produce Act on the Statue Book has caused a good many acres of potatoes to be planted. During the past fortnight, every planter, who had not yet planted his portion, planted as many as he could get cuttings to plant. These have been very scarce. Those planted last month have grown well, and are covering the ground. Potatoes are still very scarce, and dear; as much as 7 cents per lb. has been asked for them; in fact, in some districts they are unobtainable Every one should plant every kind of provision, to help in such difficult times, and it is hoped that the supply will soon meet the demand. (The Barbados *Agricultural Reporter*, September 18, 1920.)

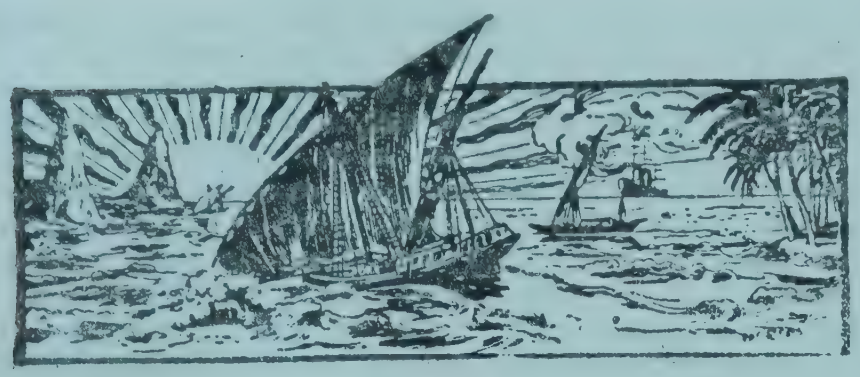
INCREASING CANE YIELD BY PRACTISING CROP ROTATION.

Interesting results have followed in the adoption in Louisiana of a system of agriculture suitable to cane cultivation, in which leguminous plants are grown as green dressings and subsequently ploughed in. The subject forms the basis of an article in *Facts About Sugar*, Sept. 11, 1920. In it are described three and four-course rotations in which leguminous crops occupy the ground for one or two years respectively, the crops then being buried for the purpose of providing humus and nitrogen for the plant canes which follow. Among the leguminous crops grown in Louisiana are peas, velvet beans, alfalfa, red clover, alsike, and sour clover (*Melilotus indica*). These are accompanied occasionally by corn or oats, especially on the poorer lands of estates where all or some of the fodder crop is harvested for feeding mules.

It is stated that an acre of peas grown to precede plant canes in the Louisiana rotations mentioned above, and ploughed into the soil, brings about an increase in the yield of the cane crop of 3 to 5 tons of cane per acre.

In view of the fact that increased attention is being drawn to the importance of humus as a constituent of soils, especially in connexion with the recent discovery that certain organic compounds present in humus probably play a part in relation to the life of the plant similar to that played by vitamines in animal physiology, it would seem advisable for West Indian cane planters to give greater consideration to the possible advantages which may follow on a more extensive practice of the principles of crop rotation.

In certain regions in the West Indies, land which has long been under cultivation is becoming dangerously near the point of deficiency in humus, and it is in these districts that rotations including a crop grown for green dressing may yield beneficial results if introduced into the system of husbandry. In the past, possibly crop rotation was more commonly practised in cane-growing districts of the West Indies than nowadays, and there is a tendency for planters to lose sight of the risks that are being run in ignoring an old and tried principle. It is to be hoped that the trend of modern thought in connexion with the humus question, as hinted at above, may cause a reversion to old methods, the practical value of which is repeatedly being demonstrated.



GLEANINGS.

Tropical Life for August 1920 calls attention to the fact that, the waste molasses produced in Hawaii alone amounts to about 135,000 tons per annum, sufficient to produce about 9,000,000 gallons of industrial alcohol. It seeks to know what can be the total waste from the world's sugar estates, since they produce to-day 12,000,000 tons of sugar, of which Hawaii produces only 500,000 tons or less than one twenty-fourth.

It is stated in *Sugar*, September 1920, that by a compilation of figures from various nations, it is shown that the worlds production of coal in 1919 seems to have dropped back to the level of 1910. Perliminary estimates place the total output of all coal mines in 1919 at 1,290,000,000 tons. This is 162, 000,000 metric tons less than the production for 1918, and about 171,000,000 net tons less than for 1913.

A correspondent to the *Chamber of Commerce Journal*, September 3, 1920, writes that it is intimated as one direct outcome of the Imperial Press Conference in Canada, that British and Australian capital will be interested in Canada's growing pulp and paper industry. In this direction Newfonndland is also attracting capital, the two producing companies now there having exported 22,819 tons of paper, 3,128 tons of pulp, and 4,023 tons of sulphite

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A note in the *Journal of the Royal Society of Arts*, September 3, 1920, states that the British Leather Manufacturers' Research Association having been approved of by the Department of Scientific and Industrial Research, as complying with the conditions laid down in the Government scheme for the encouragement of industrial research, has been granted a licence by the Board of Trade. Reports on the working of this association will be of interest to those concerned in the leather industries.

According to E. Aruch, *L' Italia Agricola*, 55, No. 10, 1918, the composition of coffee dregs compares very favourably with that of maize, coarse bran, oats and rice bran. When fed to cows, horses, pigs, rabbits, chickens and ducks, coffee dregs prove to be an excellent food. They must be fed very dry and well powdered. A cow may consume 2·2 lb. per day, and a horse 1·7 lb. The dregs are particularly well suited to milch cows as they favour milk production, and to pigs which digest the fat of the dregs much more completely than do other animals.

The *Cuba Review* for August 1920, states that crude oil, which has been introduced very extensively in the United States and Europe as a factor in the production of steam, has found its place in the island of Cuba among central sugar factories and railroads. Its adoption is meeting with great success there, for not only is it more economical than coal in respect of cost, but oil-burning locomotives cannot drop cinders along the roadbeds as do the coal-burning locomotives, and thus a stop will be put to the fires caused in this way, which formerly have involved great losses.

Alcohol can be used without blending in automotive engines if the carbureters and cylinders are redesigned for efficiency. It cannot be blended directly with gasolene, but mixtures of alcohol, benzol and gasolene can be made which will not separate on standing. Such mixtures are being used in a limited way at the present time, and it is probable that this use of alcohol will increase if the price of motor gasolene increases, as alcohol can be produced from a large number of vegetable waste products. (*Sugar*, September 1920.)

In the early sixties Porto Rico for many years only produced between 60,000 to 70,000 tons of sugar annually. Since then the production has risen from that level up to a production about seven times as great from the time of the American occupation. From 1915 to 1919 the three Porto Rico sugar crops reached an average of about 435,000 long tons per annum. There was a decrease in the 1918-19 crop owing to drought, but in 1919-20 it rose again, and the estimated crop for that season is about 427,000 long tons. (The *Louisiana Planter*, September 4, 1920.)

A note in the *West India Committee Circular*, September 2, 1920, states that a quantity of salt is produced in the Cadiz area of Spain by the evaporation of sea-water which is held in high repute, and especially for the curing of fish. The harvest of this salt in 1919 was estimated at 270,000 long tons. Lagoons, bordered by low tidal lands, connect the Bay of Cadiz and the Atlantic, and at high tide these lands are under water, but drain off at low tide. From May to September there is no rainfall, and the hot sun evaporates the sea-water. During this period the process is assisted by continuous strong land breezes, which create a constant ripple, and thus cause the fine large grain of the salt.

In spite of the difficulty attending the export of oranges from Rhodesia, Dr. Nobbs, the Director of Agriculture for Southern Rhodesia, considers that the prospects of establishing an important overseas trade in citrus fruits are promising. Well over 150,000 citrus trees have been planted, and already last year nearly 70,000 were in bearing Some 5,000 boxes of citrus fruits were exported to Europe, and in addition, considerable quantities were supplied to the local and Union markets. The figures for this year are given as 10,000 boxes of fruits, and assuming that no devastating calamity occurs, Dr. Nobbs forecasts the output in the next ten years to be 1,000,000 boxes. (*The Field*, September 4, 1920.)

SUGAR INDUSTRY.

THE SUGAR INDUSTRY OF THE PHILIPPINES.

In an article in *Sugar*, September 1920, it is stated that the sugar cane, and the manufacture of sugar from the cane were introduced into the Philippine Islands by Chinese, evidenced by the fact that different names of implements and precesses used in the manufacture of sugar are decidedly of Chinese origin. Also, Magellan in 1521, when he discovered the Islands, found a small sugar industry which was quite similar to that of the Chinese, and the sugar produced was like that of the Chinese fine-grained sugar.

The sugar industry of the Philippines did not become of real importance until the year 1849, when encouragement was given by the clerical order of the Recoletanos, under whose jurisdiction the island of Negros was placed in that year by the then Spanish Governor-General. Further encouragement was given the industry by the high prices obtaining during the Crimean War, which made the cultivation of sugar-cane and the manufacture of sugar therefrom for export profitable.

It is stated that the Philippine Islands possess climatic conditions which are particularly favourable to the cultivation of the sugar-cane. The dry season starts from one to two months before harvest begins, thus permitting the cane to reach a very high standard of purity—sometimes as much as 92° after a year's growth. The rainfall during this period is usually sufficient to keep the ground moist, and to start the growth of the ratoons and newly planted canes. During the rainy season, which begins about June and continues with intermediate rains and sunshine until October or November, the ground should be provided with proper drainage, and except for occasional weeding, little or no cultivation is necessary during this period. If proper attention is given, the cane will make luxuriant growth in this season; but the heaviest growth occurs just at the close of the rainy season, when the ground is yet moist.

The article referred to the above states that there are some five or six varieties of native cane growing in the Islands, these being of various colours, including yellow, green, pink, red and one that is almost black. In recent years, the Philippine Bureau of Agriculture has introduced more than forty improved varieties from various sugar-producing countries. Many of these canes have proved far superior to the native canes, giving a greater tonnage and heavier yield of sucrose. Besides, they are stronger and better able to withstand storms, and attacks by insect pests.

With regard to labour, which is mostly done by hand, it is stated that although not abundant, in normal conditions there is usually a sufficient supply. There is, however, a lack of trained factory labour, but this is improving gradually as more labourers pass through the existing central factories and obtain a preliminary training. It is hoped that in the course of a few years there will be no lack of factory labourers, whilst field labour may be lightened by the use of mechanical implements.

In preparing the land for sugar-cane, the soil is well broken up by ploughing and cross-ploughing. Disk and harrows are then used, until the seed bed is in good condition. On many of the small plantations the native method of using a wooden plough and wooden harrow is practised; these implements being drawn by a 'carabao' or water buffalo. On the larger estates, however, steam or gasolene power is used, and the modern implements serve to loosen the soil to a much greater depth than is possible with the old methods. Tractors and agricultural machines are being imported into the Philippines from the United States of America, which shows that the people learning the value of modern methods

Planting is usually started early in December and continues for some five months. The top joints of the cane, are used for planting. These are cut in lengths of 6 or 8 inches and after receiving a preliminary soaking of one or two days in running water, are planted in rows usually 6 feet apart.

The sugar-cane is cultivated in thirty-eight provinces of the Philippine Islands, not to mention Mindanao and Sulu. It is estimated that in 1917 the land then under cultivation was well over 400,000 acres. This area, it is stated, may be more than doubled this year.

The cane is ratooned or not, according to the location, and in a few cases, more than three times. To increase the, stooling, the first shoots from the ratoons are sometimes broken down, and some cultivation is done between the rows with plough or hoe.

In the Philippines, the sugar-cane is practically free from contagious or infectious diseases; those diseases that have occurred could always be traced to negligence in cultivation.

The exports of sugar from the Philippine Islands for the years 1889 to 1893 inclusive, are given as approximately 205,169,617 kilos, or slightly less than the exports for 1917. Between the period from 1893 to 1904, the sugar exportations dropped considerably, and from 1905 to 1909 a gradual increase was noted. Following the installation of improved machinery and central factories in various parts of the Islands, there was a great increase in the sugar export during the years subsequent to 1910.

The first large central factory in the Philippines was erected by Americans on the island of Mindoro, and the first large sugar mill was erected in 1910. This first mill, which is capable of crushing 800 tons of cane per day, was followed by another on the island of Luzon, which has extended considerably, and is at present capable of crushing 1,800 tons per day.

There are now several central factories, and others in process of construction in the Philippines, the approximate seasonal tonnage capacities ranging from 8,000 to 25,000 tons.

There can be no doubt that the cane-sugar industry of the Philippines will develop rapidly in the near future, both through the expansion of the existing centrals, and through the building of new ones.

It is stated that with the assistance of practically unlimited capital, and guidance for planters to increase yields, and to combat diseases, there is no reason why the Philippines should not come into the foremost rank of the sugar-producing countries. A few years ago the sugar industry of these Islands was more than thirty years behind in development as compared to those of the Hawaiian Islands and Java; but now it can be their equal. Scientific cultivation, seed cane selection, manuring and irrigation can increase the yields at least twofold.

The large production in the future of 1,000,000 tons of sugar per year, it is stated, is not a remote possibility for the Philippines.

CRYSTALLIZABLE SUGAR FROM REEDS.

The following note on the production in Germany of crystallizable sugar from certain reeds found growing in abundance in ponds and rivers in that country, was published in *Sugar*, September 1920, and is here reproduced as of interest in connexion with the efforts being made to replenish the present shortage in the world's supply of sugar.

In the course of a series of experiments with plants known to have a comparatively large quantity of carbohydrates in their sap, investigators recently tested several species of reeds which grow in abundance in ponds and rivers of Northern and Central Germany. It was found that, while the reeds themselves showed no sucrose whatever, the roots were exceedingly rich therein, containing in fact, a greater sucrose percentage than some cane varieties regularly planted for sugar production. According to the analysis made, reed roots contain 7·15 per cent. of albumen, 29·56 per cent. of sucrose, 25·49 per cent. pentosanes, and 30·30 per cent. fibrous materials.

The surprisingly high contents in sucrose naturally arrested the attention of all chemists throughout Germany, and many further analyses were made, as soon as the result was published, with the idea of checking up this discovery. But additional experiments only confirmed the first analysis, and arrangements are now being made to utilize the inexhaustible supplies of reeds for the manufacture of sugar and other products allied thereto. One of the important features of the proposition is the comparatively cheap labour of pulling reed roots from the muddy bottoms of rivers and ponds. Ploughs of special construction have been designed for this purpose.

Experiments made with these roots show that, not only can sugar be extracted from them in a commercially feasible manner, even under pre-war sugar conditions, but industrial alcohol can also be manufactured without a single change in the equipment required in alcohol distillers using corn husks, potatoes, and other materials. A ton of reed roots will give about 60 quarts of good alcohol, while under further treatment, a rum of excellent quality is obtained. By proper treatment, with other ingredients, it was possible to manufacture a heavy, dark-coloured beer, resembling in taste and general appearance porter beer.

It has also been found that the resulting mash yields still another product, called 'fragmit', which has been found to constitute an excellent food for horses when mixed with oats, while in its unmixed state it is a good food for cattle and pigs.

IMPLEMENTAL TILLAGE IN TRINIDAD.

Reproduced below, as of interest to sugar-cane planters at this time, is a report by Mr. Joseph De Verteuil, F.I.C., F.C.S., Superintendent of Field Experiments, Trinidad, on implemental tillage carried out at St. Augustine Experiment Station during 1919, which was published in the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XIX, Part I.

On the termination of his contract with the Waterloo Estates in February, 1919, the services of Mr. C. J. Barrilleaux, formerly of the Audubon Park Sugar Experiment Station, Louisiana, were obtained for six months by the Government to give demonstrations and conduct implemental tillage at St. Augustine Estate. On the expiration of this contract, Mr. Barrilleaux was asked to extend his appointment to the end of October so as to be able to give demonstrations on the different methods of using the implements for preparing land for cane planting.

Work was started on February 25, 1919, and consisted of :—

(*a*) Cultivating growing canes.
(*b*) Breaking and levelling land to reform beds.
(*c*) Breaking and preparing land for planting canes.

IMPLEMENTS.

The following were the implements imported and their cost landed in Port-of Spain :—

From S. L. Allen & Co., Inc., Philadelphia, Pa., U.S.A.
Two No. 82 'E' horse-hoes ... ... $ 15·53 each.
One Double Celery Hiller less leaf lifters or Double Mould Board Plough ... ... $ 26·55
From the Moline Plow Co., Inc, Moline, Ill., U.S.A.
One Louisiana 4 mule breaking plough No. 12 with knife coulter and No. 5 gauge wheel with 2 extra shears ... .. $ 32·98
Two Louisiana black land plough No. 9 with La Clevis knife coulter and gauge wheels with two extra shears ... $ 24·55 each.
Three famous pony S.B. or '1 mule' plough with No. 5 gauge wheels and extra shears $ 12·99 each.

A harrow devised by Mr. Barrilleaux was made at the Government Farm at a total cost of $ 10 50. It consists of a frame 4 feet square made of 4 in. × 4 in. hardwood with two bars across of similar dimensions. Twenty-four spikes made of ¾ inch square iron bars are fixed in the frame and cross bars at a distance of one foot. These spikes protrude 5 to 6 inches below the frame, and are tapered off to a point. The chain for drawing the harrow is fixed on to one of the angles of the frame, so that it works diagonally, and is easily guided by means of a piece of rope tied to the opposite angle.

In working out the cost of implemental tillage the depreciation of the implements is placed at 3 cents per acre for the horse hoe, pony plough and harrows, and 6 cents for the other implements. This is based on the assumption that the implements will work 100 acres per annum, and last five years.

No allowance is made for depreciation of animals, as generally, the stock on estates is more than sufficient to perform this work out of crop when they would be idle. Moreover, the extra feed given to the animals keeps them in better condition for the coming crop. It may, however, be mentioned that in the opinion of one of our leading sugar planters, the life of mules working in ploughs throughout the year would be shortened by three to four years.

Two mules were purchased from the United States of America, but they only arrived in the colony at the beginning of May, meanwhile the work was performed with oxen.

AREA CULTIVATED.

Cultivating plant canes	9·25	acres.
Cultivating ratoons	19·13	„
Cultivating, moulding and subsoiling ratoons	16·22	„
Breaking land, filling old drains and levelling to reform beds	3·73	„
Breaking land (first ploughing) ...	23·27	„
Total area worked ...	71·60	„

Between August 8 and October 15 (69 days) the following work was performed :—

Reploughing, filling drains and levelling to reform beds	11·16 acres
Reploughing to plant canes ...	10·76 ,,
Harrowing with locally made harrow	8·20 ,,
Drilling with plough	10·00 ,,
Banking with Celery Hiller... ...	10·00 ,,
Sub-soiling bottom of drills... ...	10·00 ,,
Area re-worked	60·12 acres

FEED OF ANIMALS.

During this period the oxen received on each working day an extrafeed of 2lb. oil meal, 2 lb. coco-nut meal and 4 lb. crushed corn on cob, costing 26½ cents per head. No extra feed was given to the mules, as they only worked in short spells and their work was comparatively light. Their daily ration was 7 lb. oats and 1 lb. bran, costing 31¼ cents per day. Under estate conditions the extra feed of the mules would consist of about 6 lb. crushed grain and 1 lb. oilmeal, costing 28 cents, and this figure has been taken in compiling the results for this report.

CULTIVATING GROWING CANES.

Plant Canes. A field of 9¼ acres which had been planted in canes in October 1918, after the banks had been broken and the canes weeded by hand labour in January and February was worked as follows :—

PLANT CANES—FIELD 9, ST. AUGUSTINE—9½ ACRES.

Description of work.	Number of Labourers.	Number of Animals.	Cost of labour.
	Man days.	Animal days.	$ c.
Cultivating middles across beds with 'one mule' plough ; making two cuts. The work was performed in 11½ days of nine hours by one man, two boys and two oxen, each ox working half-day ...	34·50	23·00	9·01
Pulverising lengthways with horse-hoe up and down. The work was performed in 8 days of nine hours by one man, two boys and two oxen, each ox working half-day...	24·00	16·03	6·80
Total for 9¼ acres ...	58·50	39·00	15·81
Per acre	6·32	4·22	1·71
Extra feed of 4·22 oxen at 26½ cents per ox	...	...	1·12
Depreciation of implements ...	...	...	·06
Weeding by hand labour, 14·14 tasks per acre at 30 cents	14·14	...	4·24
Total per acre ...	20·46	4·22	7·13

The cost and the number of labourers required per acre to work these 9¼ acres by hand labour alone is shown below :—

Description of work.	Labourers.	Cost.
		$ c.
Forking 13 2 tasks at 40 cents ...	13·20	5·28
Weeding 16·5 tasks at 30 cents ...	16·50	4·95
Total per acre ...	29·70	10·23

From the above it will be seen that to plough and cultivate an acre of land in young plant canes by implements with oxen in one day, it takes 6·32 labourers and 4·22 oxen at a cost of $2·89, as against $5·28 for forking by hand with 13·20 labourers—a saving of $2·39 and 6·88 labourers in favour of implemental tillage. It should be pointed out, however, that the land is not so completely tilled with implements as is the case with hand labour—on the other hand, whereas it is comparatively easy to get the labourers for implemental tillage, it is more difficult to get sufficient forkers when they are needed. It has been assumed above that the forkers make a task a day, but as they usually make a task and a half, the number of labourers required to fork an acre would be 8·80, an advantage still of 2·48 labourers in favour of implemental tillage.

After the land has been forked it is left in a much rougher condition than when worked with implements, and in the subsequent weeding it takes 2·36 labourers less to work an acre with an equivalent saving of 71 cents, i.e. a total saving of $3·10 and from 4.84 to 9·24 labourers per acre.

If mules had been used instead of oxen, these 9¼ acres could have been worked in 9¼ days by a man and a boy with one mule at a cost of 92c. per acre, including depreciation of implements and extra feed of mules. This would mean a saving in favour of implemental tillage of $4 36 per acre and 12·42 or 7·02 labourers according as the forkers worked, one, or one and a half tasks a day. To this must also be added the saving of 2·36 labourers and 71 cents per acre on the subsequent weeding.

Ratoons.—Cultivating Flat. An 11-acre field of which 6 acres were first ratoons and 5 acres were third ratoons, was worked as shown in the table below. The canes were cut at the end of April and beginning of May. In order to work the land with implements the trash had first to be hauled in the drains, and afterwards it was respread over the land and the drains cleaned by hand labour.

(*To be Continued.*)

Agricultural tractor trials are being organized by the Ministry of Agriculture, Egypt, to take place in that country about the last week in January 1921, and the end of March the same year. It is stated in the *Weekly Bulletin of the Department of Trade and Commerce*, Canada, August 30, 1920, that successful trials with Ford and other tractors have led the Ministry, with a view to developing Egyptian agriculture, to make arrangements for new experiments, when it is hoped that several models of British tractors will be shown, and their workings proved satisfactory for Egyptian soil conditions.

MARKET REPORTS.

London.—The West India Committee Circular, September 2.

Balata—Venezuelan Block, no quotations; West Indians Sheet, 4*s.* 3½*d.* to 4*s.* 4*d.* c.i.f., spot, 4*s.* 7½*d.*
Beeswax—No quotations.
Cacao—Trinidad, 90*s.* and Grenada, 80*s.* St. Lucia, Dominica, and Jamaica, no quotations
Copra—£54. 10*s* c. i. f. London, and £55. c. i. f. Holland.
Honey—80*s.* to 85*s.*
Lime Juice—Raw, 3*s.* to 3*s.* 6*d.* per gallon; Concentrated, no quotations.
Pimento—4*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T. S. Garraway & Co., September 28.

Arrowroot—$8·00 per 100 lb. duty paid.
Cacao—Lottings at $17·00
Coco-nuts—$65·00 husked nuts.
Hay—Sales at $6·00.
Onions—Lottings at $12·00.
Peas, Split—No quotations; Canada, $13·00 small, $15·00 large.
Potatoes—Sales at $16·00
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record July 20.

Bay Oil—30*s.* per lb. spot, and 28*s* forward.
Lime Oil—7*s.* 6*d.* for West Indian distilled, and for hand-pressed 25*s.* 6·*d* per lb.
Orange Oil—West Indian, 40*s.*

Trinidad.—Messrs. Gordon, Grant & Co., August 6.

Cacao—Venezuelan, $17·25 to $17·50.
Trinidad, $16·50 to $17·00.
Coco-nut Oil—$1·45 per gallon.
Coffee—Venezuelan, 20c. to 24c. per lb.
Copra—8c. per lb.
Dhal—No quotations.
Onions—5c. per lb.
Peas, Split—$11·00 per 100 lb.
Potatoes—English, 11c. per lb.
Rice—Yellow, $14·50 White, No. quotations.
Sugar—No quotations.

New York.—Messrs. Huth, Gillespie & Co., Inc. September 15.

Cacao—Caracas, 14c. to 14½c.; Grenada, and Trinidad, 13c. to 14c.; Jamaica, 10c. to 11c.
Coco-nuts—Jamaica selects, $55·00 per M; Trinidad 52$·00 per M; Jamaica, $35·00; Trinidad $30·00 per M. culs
Copra—7¾c.
Coffee—Jamaica, 10c. to 13c. per lb.
Ginger—34c. to 38c. per lb.
Goat Skins—Jamaica 70c, Antigua, Barbados, St. Thomas and St. Kitts 65c.
Grape Fruit—Jamaica, $3·00 to $5·00 per box.
Limes—$6·00 to $8.00 per bbl.
Mace—26c. to 28c.
Nutmegs—17½c.
Oranges—$5·00
Pimento—7½c. per lb.
Sugar—Centrifugals, 96°, 10c.; Muscovados, 89°, 9c.; c. & f., Molasses, 89°, 9c.

Special Selected Sea Island Cotton Seed

— FOR —

PLANTING PURPOSES.

We can supply you with the above, selected from Seed grown at the Government Industrial Schools, and the Lunatic Asylum Farm, under the supervision of the Agricultural Department. Lint from this Seed has been highly reported on by the Spinners in England.

WE SOLICIT YOUR ORDERS.

The Barbados Co-operative Cotton Factory, Ltd.

WHITE PARK.
May 15, 1920.

AGENTS FOR PUBLICATIONS OF THE IMPERIAL DEPARTMENT.

London: Messrs. Dulau & Co., Ltd., 34-36, Margaret Street, Cavendish Square, W.
West India Committee, 15, Seething Lane.
Barbados: Advocate Co., Ltd., Broad Street, Bridgetown.
Jamaica: The Educational Supply Company, 16, King Street, Kingston.
British Guiana: The Argosy Co., Ltd., Georgetown.
Trinidad: Messrs. Muir-Marshall & Co., Port-of-Spain.
Tobago: Mr. C. L. Plagemann, Scarborough.
Bahamas: Mr. N. D. Sands, Board of Agriculture, Nassau.
Grenada: Messrs. Thos. Lawlor & Co., St. George.
St. Vincent: Mr. Floris Simmons, Experiment Station.
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Dominica: Mr. W. G. Hutton, Botanic Garden.
Montserrat: Mr. W. Robson, Botanic Station.
Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre.
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 801, Yonge Street, Toronto

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A FORTNIGHTLY REVIEW

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Colonial Development.

II.

IN the last issue of this Journal reference was made to proposals put forward, chiefly in connexion with French colonies, for fostering colonial development by means of carefully planned and adequately sustained agricultural investigation, research, and education; the need for such development being recognized as both in the interest of the colonies themselves, and of the mother countries to which they belong.

Reference was also made to the developments which have taken place in recent years in British West Indian colonies, and it was claimed that these developments had been materially aided by the conditions of preparedness, which had been to some extent induced through the operations of such activities as the French Congress advocated for general application to French colonies.

In the instances referred to, the development mainly took the form of improving or establishing industries in colonies which were in a condition of industrial and financial depression. The working population, skilled and unskilled, was, for the most part, on the spot, but was ill-supported by the local industries which were in a condition of some difficulty. Knowledge, skill, and a market enabled industries to be improved and developed.

There are other aspects of colonial development which deserve consideration.

In many instances, as soon as the period of difficulty and depression has been got over, it is found that the possibilities of the revived or newly created industries transcend the capacity of the workers: a labour shortage is found, or stated to exist, and possible developments are held up.

When attempts are made to introduce industries into new countries, this labour shortage frequently manifests itself at quite an early stage; consequently developments may be slow, or even be hopelessly retarded.

In some instances there is a working population on the spot, and it may be possible to introduce new industries, or to expand old ones by drawing on this population, and making work attractive to them. If

development takes place at a moderate rate, this may serve for quite large expansions in the course of time, for with the introduction of methods which conserve labour and render it more efficient, it is possible to sustain a marked growth in an industry with a moderate increase in workers, or even with no increase at all.

There is a tendency on the part of all healthy and well-employed communities to increase in number of population, and this increase may enable considerable industrial and agricultural development to take place in a country. It has been characteristic of several West Indian communities, that they have not shown the normal increase in population: this is a very significant fact. It probably reflects several causes: in the first place the acute agricultural depression which characterized West Indian conditions up to about ten years ago, doubtless is accountable for lack of virility which such a condition implies: times were hard, wages were low, and employment laborious and somewhat uncertain.

Another feature which retards the normal increase in population, a feature which has a marked influence in tropical countries, is the general health of the community. In the tropics there exist forms of disease which play a prominent part in this connexion: such diseases as malaria, filariasis, and hookworm. The incidence and effects of these commonly occurring diseases are greatly accentuated by the general industrial welfare, so that in circumstances of agricultural and industrial depression, such as have affected many West Indian communities in the past, the influence of these enervating diseases has, no doubt, been largely responsible for the lack of adequate population to permit of the full development of enterprises which changed conditions otherwise render possible, and which economic pressure is tending to force on these islands.

It would seem, therefore, that there is a readily available means of increasing the efficiency and number of workers by paying attention to public health. It is doubtful if there is any more profitable investment open to most tropical colonies than is thus offered. In the first place, the eradication or even the limitation of the three enervating diseases referred to will at once increase the efficiency of the existing population, by enabling workers to be fully engaged, instead of losing a very considerable part of their working time owing to inability from sickness. The incidence of these diseases is disastrous in two ways: the worker is incapacitated from actual productive employment, his energy is sapped and his output lessened; in addition to this, his resources are drawn upon to maintain himself during periods of sickness, and to furnish remedies and attendance which sickness necessitates.

Money spent in intelligent efforts to remedy these things will, undoubtedly, prove highly remunerative, and must be amongst the first matters for consideration on the part of all those in any way concerned with colonial development. It may be taken as an axiom that, where in these West Indian communities the population does not exhibit the normal increase in number, there is something radically wrong, and investigation will propably show that serious defects in matters of public health are responsible. It may be suggested that in many West Indian communities attention to matters of public health will be the most readily available and economical manner of making good any labour shortage that can be adopted. The results will be speedy, far-reaching, and permanent.

There are other aspects of labour shortage which tend to hamper colonial development. In what has been already stated, regard has mainly been directed to those places which have a moderately large, but still inadequate population. There are other places in which there are possibilities of development, where it is thought new enterprises should prove remunerative to the benefit alike of the area to be developed and to the mother country awaiting enhanced supplies of colonial products, but where development is hampered or rendered difficult from complete lack of population. In such cases attention is directed to the importation of workers from outside. This aspect of the question is receiving consideration in the case of British Guiana, where carefully planned schemes are on foot for the introduction of East Indian agricultural workers under conditions which promise to be of benefit alike to the workers and to the colony. There are many colonies similarly situated to British Guiana, and the success of the organized efforts there being made, is being watched with great interest, in the hope that they may be adopted in other places.

In tropical countries the difficulty of introducing agricultural workers from other places is increased by the fact that they are tropical, and that natives of temperate climates are not able to endure the high

temperature which work in the field implies; consequently attention is directed to tropical countries for immigrants. It is worthy of note, however, that in Cuba, a large proportion of the workers are natives of Southern Europe, or their descendants.

The fact nevertheless remains, that in all efforts at colonial development, whether this development concerns new countries or countries already developed to a considerable extent, one of the main factors is that of the labour supply. Developments can only take place to the extent that there are people to sustain them. The care of the worker becomes, therefore, not merely a matter of philanthropy, but a fundamental business conception. If it is not dealt with in a proper and businesslike manner, there will be little or no development.

PLANT SANITATION.

'Plant Sanitation', is the subject of an article in the last number of the *Transactions* of the British Mycological Society (Vol. VI, part 3). The article is written from the standpoint of English fruit growers, but the general principles involved are the same for all plantations, and cannot be too often repeated.

With plants, even more than with animals, prevention is better than cure, for owing to the absence of anything comparable with the blood stream of animals, medical treatment of plant diseases is impossible. The nearest approach to medical treatment in plant pathology is the use of fungicides and insecticides. Certain diseases can be entirely, or almost entirely, controlled by spraying, provided it is done at the right time, but much money may be wasted by spraying at the wrong time.

Surgical methods may sometimes be applied successfully to trees, but more important than all these ways of treatment of disease are hygienic measures, designed to prevent the occurrence of disease by the eradication of the sources of infection. The principle is the same as that which has been applied successfully in the case of human diseases, such as yellow fever or malaria. While it may not be possible to destroy the parasite completely, it is well known that disease is less likely to become established when the number of organisms available for infection is small.

The first principle of sanitation therefore, is to avoid as completely as possible all harbourage for insect and fungoid pests. This involves the cutting off of all branches which are dying back, and their speedy removal from the plantation, or destruction by fire. When large branches are severed, the exposed surfaces must be made smooth, and covered with some antiseptic substance like tar to prevent the ingress of wound parasites.

When a tree has died, or is dying back to such an extent that loss is inevitable, complete removal is necessary, and it is important that the stump should be removed, if possibe at time of felling. In the tropics especially, stumps which are allowed to remain, provide dangerous starting-points for destructive root diseases.

Precautions against the development of dangerous fungi are necessary, not only in the plantation, but also in its immediate vicinity.

In the case of large areas, the author advocates placing the operations of plant sanitation, spraying, and pruning in the hands of an expert, with a gang of men under him. This is already done in large rubber plantations in the East, each of which has its 'pest gang.'

The planter naturally, has to consider whether the sanitary measures advocated are economically sound. The initial expense of cleaning a plantation may be high, but subsequent sanitary work should be carried out at little cost. As pointed out in the Department's pamphlet No. 79 (Diseases of Lime Trees in Forest Districts), there is no question of the success of these sanitary measures when properly carried out. It is, however, for the planter himself to decide whether the loss, or prospective loss, from disease is sufficient to justify the expenditure of time and money necessary to prevent it. Consideration of the cumulative effect of fungus disease will in most cases supply an answer in the affirmative.

E.M.W.

THE FRUITING HABITS OF THE LEMON.

Paper No. 54 of the Graduate School of Tropical Agriculture and Citrus Experiment Station of the University of California, contains some interesting information on the relationship between the flowers and fruits of the lemon, which may be summarized as follows:—

(1) A small group of Lisbon lemon trees was studied for two years to obtain data on their fruiting habits. The trees stood in a large commercial orchard and received no special treatment.

(2) Approximately 66 per cent. of the fruit buds appeared during March and April, 13 per cent. appeared in November, 17 per cent. between April and November, and about 3 per cent. during the winter months.

(3) Few-flowered inflorescences predominated numerically over many-flowered inflorescences. A bud on a small inflorescence had a greater chance of developing into a mature fruit than one on a large inflorescence. The competition between individual buds on larger inflorescences seem to be too severe to allow all to survive.

(4) The time required for the fruit to reach maturity varied from seven to fourteen months, according to the conditions. The season at which fruit was set appeared to be influenced, but not wholly to be determined, by the time which was required for maturity.

(5) The records for 4,440 buds showed that 51·98 per cent. set fruit, 21·71 per cent. reached a diameter of $\frac{1}{4}$ inch, and only 6·62 per cent. reached the stage of maturity.

(6) The chances of reaching maturity diminished as the season advanced.

It would be interesting to know how closely these conditions are reproduced in the West Indies; observations would be useful. T.G.M.

DEPARTMENT NEWS.

Mr. H. A. Ballou, M. Sc., Entomologist on the Staff of the Imperial Department of Agriculture, who has been in England to attend a meeting of the Imperial Entomological Conference, and on leave of absence returned to Barbados by S.S. 'Settler' on October 7.

The Secretary-of-State for the Colonies has been pleased to confirm Mr. A. E. Collens, F.I.C, F.C.S., as Government Chemist and Superintendent of Agriculture for the Leeward Islands Mr. Collens has been acting in this capacity since April 1917.

LEATHER FROM THE SEA.

In several previous issues of the *Agricultural News* attenti n has been drawn to the development in the United States of the manufacture of leather from the hides of acquatic animals, particularly sharks. In *The Times* Trade Supplement, August 24, 1920, there is an interesting article on the commercial development of this industry, from which the following paragraphs are reproduced.

Efforts have been made from time to time to turn the hide of the porpoise and shark to economic account in the leather industry, but they have not been completely successful. Accepted principles of tanning do not suffice. Porpoise leather, for instance, is likely to be rendered spongy and vastly inferior in point of strength and durability for hard wear under varying conditions of weather and climate. On the other hand, the skin of the shark, when dressed, has been found to be too hard and too rough, as well as lacking in flexibility, for aught but limited use, as for instance, an abrasive medium in the jewellery trade.

These deficiencies have now been overcome, and the leather produced from the aquatic animals above mentioned is said to be equal in every respect to that forthcoming from the usual sources.

In the case of the shark, the separation of the outer horn-like nodule-scarred hide or shagreen from the inner skin constituted a problem. It is the latter which constitutes the valuable part of the hide, and, when dressed, it is as flexible as the accepted leather hide, although in the process of splitting, none of the toughness, durability, or distinctive beautiful markings of the shark's skin is sacrificed. This has been affected by a chemical process.

The utilization of the shark's skin constitutes the sheet anchor of these new activities, this monster being prolific around the American coast, especially in the tropical zones. Experience has proved that five sharks are caught to every porpoise, and accordingly it offers greater scope for manufacturing activity. Following the introduction of the product to the market, experts were dispatched to the various known shark-infested seas to survey the prospect and extent of raw material, as well as new zones in which the fishery might be established with every promise of success These authorities have reported that there is very little likelihood of the shark-yielding waters being exhausted or even seriously depleted for many years to come, notwithstanding the intensified character of the fishery. The waters washing the Australian continent alone are believed to be capable of supporting the industry, even when fully developed, for an indefinite period.

The fishery is conducted upon essentially scientific lines. Four stations have been established in the United States up to the present, two being in Florida waters. Each is adequately equipped with fishery tackle as well as reduction plans, since every ounce of the animals is turned to economic account.

It is the seine net which brings the biggest harvests, and the catch may readily vary from 1,000 to 10,000 big fish having suitable skins for tanning per day, according to the locality and the character of the prevailing conditions. Motor boats are employed for laying the nets, which, when a catch has been made, are hauled ashore. As the fish are landed they are dispatched and skinned, care being taken in the case of the shark to remove the dorsal fins for drying, since these find a ready market among the Chinese for edible purposes. The hide is stripped in one piece and with only four holes, is folded, salted, and then dispatched to the tannery. That the shark is a bounteous hide yielder may be gathered from the fact that the skin may vary in superficies from 10 to 40 square feet according to the size and weight of the fish. The giant devil fish gives a still larger hide, this often running up to 100 square feet.

It is not only the hide which yields leather. The softer tissues and stomach membrane when tanned yield an excellent substitute for suédc leather The dressing processes are somewhat involved, but upon their completion it is said to be impossible to distinguish the leather made from the hide of a fish from that wrought from the goat, ox, or horse. There is no possibility of identifying the leather by odour, inasmuch as a degreasing process is followed, which completely eliminates the distinctive aroma of the sea. The only means whereby the difference can be detected is by submitting the leather to the tensile testing machine or the microscope, to identify the fibrous construction.

While the recovery of the hide constitutes the primary task, the carcases of the animals are turned to the utmost account, thus fulfilling the requirements of economical exploitation. The prime portions of the fish are stated to be savoury, and shark steak is coming into increasing favour. The inedible portions are subjected to treatment to furnish chicken food or fertilizer. The demand for the last named is rapidly increasing, owing to its superiority to ordinary fish scrap in point of nitrogen content This ranges from 15 to 18½ per cent., and commands from 33½ to 50 per cent more than ordinary fish scrap manure upon the market.

The liver of the shark yields an excellent oil worth 2*s*. a gallon, while the teeth fetch 3*d*. each from the jewellery trade for conversion into various articles of adornment and utility, The blood is recovered, since it yields an excellent waterproof glue in keen demand for the fabrication of the integral propellers of æroplanes; while the gut is used for the manufacture of strings for musical instruments, fishing lines, tennis rackets, and such like. In short, no part of these fish animals is wasted. In the case of the porpoise, the oil is especially valuable. One grade derived from the jaw is the premier lubricant for watches and other delicate mechanism, and readily commands £1 per gallon. It is the scientific utilization of the various by-products of the animal which has rendered the foundation of the new leather industry so successful, and incidentally, it is the high price realized for these various other commodities which is enabling the shark leather to be placed upon the market at a severely competitive price. In fact, it is asserted that the cost of footwear made from shark's skins will be one-third to one-quarter of the prices at present prevailing.

The articles capable of being fashioned from fish-skin leather virtually comprise all those hitherto obtained from the hides of various animals. Different grades, qualities, and classifications are obtained as a result of varying the tanning process, and adapting it to the special requirements of the product under treatment. The demand of the leather for all purposes has already exceeded supply. One of the largest glove manufacturers in the country has secured the whole of the output of suéde leather made from the softer tissues and stomach membranes for the production of of this specialty.

But it is the boot trade which is advancing the heaviest demands, since the sh rtage of leather for footwear has reached an acute stage in the United States. The inner hide or split of the shark's skin is as soft and pliable, and as

durable, as the best calf and kid, although it is asserted, from the trials which have been made, to be possessed of superior wearing and lasting qualities, as well as affording complete protection against any and every weather. So far as the soles are concerned, an interesting development is to be recorded. In certain cases prolonged wear is paramount, and it has been found that the shagreen is preeminently adapted to such service. It is extremely durable, as may be gathered from the fact that it is used as an abrasive or animal emery in the working and polishing of jewels and ivory. When used for boot-soling purposes the horny, steel-like nodule-covered surface is presented to the pavement, and the wear is so slow as to outlast the heavy hobnail boot.

The industry is as yet in its infancy, but already the output has attained a huge figure. At the time of writing it is 20,000 square feet of fish leather per month, and the whole of the producing facilities of the enterprise concerned has been secured by the trade for several months ahead. To meet the increasing demand, forty additional fishing-stations are being laid down and equipped. When completed they will be sufficient to furnish to the tanneries from 15,000 to 20,000 skins from the shark, devil-fish, porpoise, blackfish, and others every twenty-four hours

JAPANESE INVESTMENTS IN THE SUGAR INDUSTRY.

An article in *Facts About Sugar*, September 4, 1920, draws attention to the interest being shown by the Japanese in the development of cane and beet projects in Shantung and Manchuria, who, it is stated, will invest millions in this direction. The following extracts are made from the article.

Reports have been received at Manila, which apparently are based on good authority, to the effect that Japanese sugar interests are planning a great expansion of sugar production in the territory that has recently come under the influence and control of the Island Empire. According to these statements, the interests that have taken a leading part in the development of the Formosan sugar industry, finding further expansion in that quarter limited by the lack of available land and the requirements of rice production, have been casting about for some time for further fields in which to extend their activities.

The first efforts in this direction were made in Korea, where a beet sugar factory owned by the Japan Sugar Company has been erected, following tests for the past several years, which demonstrated that beets could be grown successfully there. While this factory is expected to be highly successful, it is stated that the Japanese have not found Korea altogether satisfactory as a field for sugar development, for the reason that the Koreans themselves have shown little enthusiasm for sugar beet growing.

An attempt to establish the beet sugar industry in Japan proper is under way in Hokaido, where an American engineering firm is now engaged in constructing a sugar factory. It is understood, however, that the area adapted to sugar beet growing in this part of Japan is rather limited.

In Manchuria, a single beet sugar plant has been in existence near Harbin for several years. It has operated only one season, heretofore, but is expected to resume the slicing of beets this fall. It is understood that a careful survey of the beet growing possibilities of Southern Manchuria has been made by the interests above referred to, and that they are satisfied that this territory is capable of supporting several additional sugar factories.

Since the treaty of Versailles recognized Japan's succession to the rights formerly claimed by Germany in the rich Chinese province of Shantung, it is stated that the Japanese sugar syndicate has turned its attention to the project of establishing a modernized sugar industry there. As a result of their investigations, it is reported that the syndicate is prepared to spend $5,000,000 in the construction of sugar mills in Shantung and possibly a like amount in the development of the beet sugar industry in Manchuria.

The plans for developmental work in Shantung and Manchuria have been held up temporarily, according to information at Manila, by the recent financial crisis in Japan, but have not been abandoned, and are to be pushed vigorously as soon as business conditions are improved.

ABORTION AND WASTING DISEASE IN GOATS

The *Quarterly Bulletin* of the Michigan Agricultural College Experiment Station, for May 1920, contains an account of a disease of goats which has recently been studied in connexion with the importation of Angora goats into Michigan. The disease appears to manifest itself by two separate and distinct symptoms—the casting of the developing kid prematurely, and a wasting disease which always terminates fatally. Goats which are bred in the south western parts of the United States are frequently infected with the disease, and infectious abortion is also a prevalent disease of goats in Europe.

Possibly the high rate of abortion shown by goats imported into Michigan may be due to change in climate, since no definite organism could be identified in the fœtuses. The wasting disease, however, has been proved to be due to a small micrococcus (*M. caprinus*), and it is a serious problem with goat rearers in many of the States of America. It is known as 'takosis.' If once the disease appears in a flock of goats, and proper sanitary measures are neglected, all susceptible goats will contract the disease and die. Other animals such as cattle, horses, hogs, sheep, and fowls do not appear to be susceptible to this disease.

The disease usually takes a chronic course. The symptoms persist for two to eight weeks, and are very suggestive of a worm invasion There is at first noticed a great loss of flesh, general weakness, and diarrhoea; the animal will shrink to about one-half normal weight before death; appears to be free from desire, and moves about slowly; there is a drooping and a watery appearance of the eyes; no resistance is given when handled; when shoved, the animal falls to the ground and makes no effort to rise for some time; the appetite does not appear to be affected; bleating and coughing are occasionally noticed; the body temperature may range from 101°F. to 104°F.; the visible mucous membranes appear pale in colour.

A keen lookout should be kept for evidences of the wasting disease of goats in the West Indies, especially in those cases where importation from the United States has definitely been known to have occurred in the history of a herd.

F. H.

GUMMING DISEASE OF SUGAR-CANE.

The current number of *Phytopathology*, September, 1920, contains a short note by J. Matz, recording the occurrence in Porto Rico of the gumming disease of sugar-cane.

This disease, due to *Bacterium vascularum*, E. F. Smith, is known from Australia, Fiji, Java, Borneo, New Guinea, Mauritius. Brazil, and probably Tucuman, Argentina, but there has not hitherto been any record for the West Indies.

The disease is characterized by dwarfing and etiolation of the cane, stripes on the leaves, decay of the terminal bud, and reduction of the sugar content.

In the more advanced stages there is found a bright red discoloration of the vascular bundles and a lemon-yellow or honey-coloured gumming exudation from the cut ends of the cane stalk. Bacteria agreeing with *B. vascularum* were isolated from the Porto Rican examples, and the disease was produced in healthy canes by artificial inoculation from pure cultures of the organism.

Fortunately the disease is not widespread in Porto Rico. It occurs only in the Trujillo Alto district, in an area of about 15 kilometres.

As it occurs in places where no new introductions of seed have been made for many years, it is probable that it may have been present in insignificant amount for some time past, and that the unusnally heavy rains at the beginning of the present year have aided it in assuming an epidemic form in one district where the susceptible 'Otaheite' cane is generally grown.

Besides 'Otaheite,' 'Rayada,' 'Crystallina,' and 'Cavengerie' or 'Colorada' are attacked, the latter least, while 'Otaheite' is most severely infected. It has so far not been observed in the variety 'Yellow Caledonia.'

Control measures lie in the direction of selecting cuttings only from healthy canes, and using varieties resistant to the disease.

E.M.W.

GROWTH-INHIBITING SUBSTANCES IN PLANTS.

The existence of growth-inhibiting substances has lately attracted a good deal of attention, as for instance in the University of California Publications in Agricultural Science, Vol. 4, No. 3, 1919. The older botanists assumed that there was a flow of shoot-forming substances toward the apex and of root forming substances toward the base in a regenerating cutting. The difficulty underlying this assumption is that the subapical buds generally fail to develop. If the apical buds of the cutting develop as a result of the flow of elaborated materials in their direction, it is difficult to see why these materials which flow past subapical buds should not give them a stimulus to develop, though to a less degree.

In a recent series of articles Loeb has turned attention toward the possibility that there are one or more specific substances in the growing stem which determine the course of events in the growth of new shoots and roots in cuttings. He has shown that in Bryophyllum the common Leaf of Life or Wonder of the World of the West Indies, the apical bud prevents the lower ones from growing out, and he concluded that there is an inhibitory substance sent in the direction of the basal buds. He also believes that the reason why the apical bud grows out first is that it is the first bud which is freed from this substance when the stem is cut from the mother plant.

This view receives strong support from the studies on the growth of potato sprouts recently published by Appleman. He finds that when all the buds on a tuber are subjected to the same external conditions, the buds on the apical end grow out first, and that they inhibit the growth of the more basal buds. If these apical buds are destroyed, or retarded in their normal growth, sprouts will appear from the more basal buds which would otherwise have remained dormant. The cutting of a furrow around a middle or basal bud will causeeit to grow out just as quickly as the apical buds of the tuber. If the tuber is cut into transverse slices, the inhibiting influence of the apical buds is removed, and there is a general growth of buds over the surface of the entire tuber, depending on the thickness of the slices.

When cuttings made from the shoots of the Chinese lemon are suspended in a moist atmosphere, shoots develop from buds at the apex of the cuttings, and roots from the basal end, and this occurs whether the cuttings are in the normal or inverted position. The cuttings will grow for several months, but no shoots will appear except from two or three buds nearest the apical end of the cutting. If the buds nearest the apex are killed by burning them with a hot glass rod, then the buds immediately below will develop, but if the apical buds remain functional and develop, the lower buds remain dormant. If the sprout from an apical bud be moved after it has reached a length of one centimetre or more, a new sprout will develop from one of the accessory buds, but the lower buds remain dormant.

In the pear tree too, the existence of growth-inhibiting substances appears established. Young vertical shoots of the pear tree tend to remain unbranched because of the dormancy of lateral buds. Amputation of a portion of the growth of shoots is followed by a development of lateral buds situated immediately back of the point of amputation. Growth-inhibiting substances produced in the apical portion of the shoot travel toward the base, and perpetuate a condition of dormancy in the subapical buds. Horizontal shoots of the pear tree produce the most vigorous growth from buds near the dorsal line of the shoot, and little growth from the ventral side. Growth-inhibiting substances apparently accumulate on the ventral side of such a shoot, thereby freeing the dorsal buds from the restraining factors.

An objection which appears to be fundamental to the existence of growth-inhibiting substances is the retarding effect which would be exerted on the buds where they originate; that is to say, there appears to be no reason why the apical buds, where the substances are supposed to be formed, should not suffer as great a retarding effect as the subapical buds. If it be assumed, however, that a growth-promoting substance is withdrawn from the subapical buds by the apical buds, this difficulty disappears. It would be interesting to know what is the effect of one bud of the sugar-cane on another; some very valuable work could be done in this direction. The importance of these considerations in pruning of trees will need no emphasis.

T.G.M.

AGRICULTURE IN BARBADOS.

The month of September closed with a rainfall which was regular and continuous, particularly in the red soil area, and in the parish of St. Andrew.

In the black soil areas the rainfall was not as regular, but still it was fairly distributed. The amount recorded in the black and red soil areas for the past month is $4\frac{3}{4}$ inches and $7\frac{3}{4}$ inches, respectively; for the year to date $23\frac{1}{2}$ inches and $36\frac{1}{2}$ inches.

The cane crop, which was developing well, continues to do so, and the rainfall for September has added yet another touch to these canes.

The cry for more rain is still heard in the black soil districts, and it is stated that the condition of some of the ratoons is so bad that one planter has already destroyed 9 acres of his worst ratoons, and is preparing the same land now for planting another crop of canes this year.

The tillage of fields for plant canes is advancing most satisfactorily in the black soils.

Farmyard manure is being applied as rapidly as possible, but there will still be a shortage of it, and the material for making it is scarce. Where bush is obtainable, the labour supply for cutting this is short, partly owing to emigration.

Corn is now being put on the market, and there are many good fields which are not quite mature. In some places it is said that prædial larceny is still on the increase, and cornfields are frequently raided, particularly those of the peasant proprietors.

The statutory area to be planted in potatoes has not been completed yet, owing to the scarcity of slips. Those already planted are growing nicely, and with good weather give promise of a fair yield, particularly where the land is well tilled. Potatoes are now being retailed at 8 c. per lb. The yam and eddoe crops continue to do well in most parishes. The fodder supply has not yet been adequately relieved. (The Barbados *Agricultural Reporter*, October 2, 1920.)

AGRICULTURAL EXAMINATIONS, 1919.

The publication of the results of the Agricultural Examinations conducted by the Imperial Department of Agriculture for the West Indies in November last has been regrettably delayed, owing to several causes. It is now possible to give a statement of the results, which will be found below. Candidates entered for the Examinations from only two islands, namely St. Vincent and Antigua, with the following results :—

SUCCESSFUL CANDIDATES.

Name	Examination.	Class.
S. F. Leigertwood, St. Vincent.	Final	3rd
R. F. Goodwin, Antigua	Intermediate	1st
V. G Pereira, "	"	2nd
C. T. Michael, "	"	2nd

Special mention must be made of the excellent papers sent in by R. F. Goodwin. It is to be noticed that the Antigua candidates had already passed the Intermediate Examination in 1918. It is gratifying to observe that by another year's study they have been enabled to win a higher place in the list

It is desirable that more students from these islands should present themselves as candidates for these agricultural examinations Besides general study on the principles of agriculture, there is a wide range of subjects of which a young man may devote attention to some particular one, on which his interest is chiefly centred. Definite study, with the object of passing an examination, is really of greater value as mental training than mere desultory reading can possibly be.

The Imperial Department is indebted to the following planters and agricultural officers for the care and trouble exercised in the conduct of these examinations : A E. Collens, Esq., F.I.C., F.G.S., Government Chemist and Superintendent of Agriculture for the Leeward Islands; T. Jackson Esq , Agricultural Superintendent, St. Vincent; L. Punnett, Esq., St. Vincent; R. S. D. Goodwin, Esq , J. J. Roden, Esq., and Frank Goodwin, Esq., Antigua.

The examination papers were prepared as usual at the Office of the Imperial Department of Agriculture, Barbados, and the reports of the local examiners and the corrected papers were examined by Sir Francis Watts, K.C M G., Imperial Commissioner of Agriculture, and Reverend C. H. Branch, B.A. Acting Scientific Assistant.

The questions set for the final paper will be found below Those set for the candidates for the Intermediate examination will be published in the next issue of the *Agricultural News*.

FINAL EXAMINATION.

GENERAL.

A.—Production of Plants.

1. Discuss the various considerations involved in the application of lime to the soil.

2. Give an acconnt of plant legislation in St. Vincent.

3. What is the general outlook for agricultural industries other than sugar and cotton in St. Vincent;

B.—Production of Animals.

1. Give your views as to the practicability of starting a West Indian Herd Book.

2. Describe a specific disease of domestic animals which is not caused by bacteria. What preventive and curative measures may be employed?

3. Discuss the economy of purchasing foodstuffs as against growing them.

C.—Construction on Estates.

1. Give your views as to the value of motor-tractors, with special reference to St. Vincent.

2. What different kinds of drainage systems are you familiar with? Describe briefly how they are constructed.

3 Describe how you would construct an estate road between any two points you may select, and indicate the position of.

D.—Economics.

1. Describe the value to St. Vincent of the Land Settlement Scheme. What has assisted in making it a success?

2. Give an account of the distribution of the labour supply in St. Vincent.

3. State what you know concerning the history, work, and achievements of the St. Vincent Agricultural Society.

N.B.—Not more than *six* questions to be attempted. *One* to be selected from each section

SPECIAL CROP SUBJECTS.

A.—Sugar.

1. In what respects might the cultivation of sugar-cane in St. Vincent be improved upon? What is the usual system in your district?

2. Discuss fully the factors which limit the production of sugar in St. Vincent.

3. From what sources do you obtain manure other than by importation? Discusss its use and value.

Cotton.

1. Give a short account of the principal results of economic value obtained during the past three years from breeding investigations with cotton in St. Vincent. Indicate how the planter is benefited.

2. Discuss fully the factors which limit the production of cotton in St. Vincent.

3. Describe all the features of a good cotton estate in St. Vincent.

N. B.—Only two questions from each section of this paper *need be attempted*.

EDITORIAL NOTICES.

Head Office — Barbados.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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NOTES AND COMMENTS.

Contents of present issue.

The subject of colonial development is continued in the editorial.

A continuation of the report by the Superintendent of Field Experiments, Trinidad, on implemental tillage, will be found on page 334.

An article on page 324 draws attention to the remarkable development now taking place in the United States in the manufacture of leather from fish skins.

Two notes on seeds, one on their dormancy, and another on their longevity, will be found on page 230.

Notice is drawn to a disease of sugar-cane appearing in Porto Rico, not hitherto recorded from the West Indies, in a note on page 226.

A New Sugar Cane Mill.

The *Louisiana Planter* for September 4, 1920, gives a short account of a new invention, due to J. J. Armstrong, of Honolulu, which is hoped to remove one of the main drawbacks of the modern cane mill. Most present day mills possess a hydraulic device which applies a pressure to the top roller of the three-roller unit, and at the same time allows of movement of this roller, sufficient to prevent the breakage of the mill, should the incoming mass of canes increase in bulk. The movement of the roller, however, not only causes a greater space to occur between itself and the receiving roller, but also widens the space between itself and the discharging roller. Hence the pressure on the crushed cane as it passes between the last two rollers varies with the alterations in thickness of the mass of canes entering the mill. This is a decided disadvantage, and any device which will tend to cause uniformity in the pressure between the top roller and the discharging roller will naturally greatly increase the efficiency of the mill.

The invention described is stated to bring about this desired result. Armstrong's arrangement permits a shifting of the centre of the hydraulic pressure to such an angle as the incoming cane may require, without reducing the last of the two pressures of the three-roller mill. The diagrams given in the article cited convey some indication as to how the new mill is constructed, and are well worthy of study by sugar technologists and engineers.

A Better System of Agricultural Education.

Through the establishment of experimental farms, the circulation of literature, and other propaganda matter, and many other methods, the Federal and Provincial Governments and the Railways of Canada have never ceased to work for the progress and development of the country's agricultural industry. However, a yet better system of education and aid to more successful farming has been devised in the 'better farming train,' or as it has come to be more popularly termed, 'the university on wheels.' According to a note published in The *Colonizer*, August 1920, this train journeys through the prairie provinces of the west, under the auspices of the Provincial Department of Agriculture and Education and the Canadian Pacific Railway, and is, in truth, a travelling university of agriculture, bringing an agricultural course to the farmer's home, with its intensive classes and demonstrations of the highest educational value.

The train carries two large cars for the live stock and their food supply, and two flat cars, one fitted up to carry sheep and hogs, and the other for demonstration purposes. These cars, it is stated, are fitted up under the direction of the Professor in Animal Husbandry at the University of Manitoba. There are also three large coaches, used in displaying field

husbandry exhibits, and a car for the dairy, mechanical, building, and poultry displays.

A very popular feature of the train is said to be the moving picture car, where films for entertainment, as well as those of educational value, are shown. Two cars are fitted up for lecturing purposes, one for men, and the other for women. In addition, there is a nursery car, provided with sand-piles, slides, and cribs, in charge of capable nurses, where mothers may leave their children whilst attending the lectures, etc.

It may be mentioned that credit is given to the Canadian Pacific Railway for furnishing the train with its entire equipment, free of cost. This Company, it is stated, has done everything possible to make the 'farming train' of the greatest service and assistance to the agriculturists of Canada.

Camphor and Camphor Oil in Formosa.

As is well known, the Island of Formosa has hitherto been the greatest producer of camphor in the world. A note in the *Perfumery and Essential Oil Record*, September 1920, states that the output of camphor from that Island shows a serious falling off each year since 1916-17. The chief cause of this decrease is put down to insufficiency of labour. Apart from this, however, the future of the industry is far from bright, as it is estimated that the natural camphor forests will be entirely exhausted in about fifteen years time. Only a very small proportion of recently planted trees will have reached the age of maturity when they can be advantageously cut down by that time. It appears that in Formosa the age of maturity at which the trees are cut is about fifty years. Compare this wasteful system with the distillation of camphor from leaves and twigs as practised in Florida.

Development in Australia's Raisin Industry by Co-operation.

From a note published in *The Board of Trade Journal*, September 9, 1920, it would appear that co-operation has been the main factor in the success and development of Australia's raisin industry.

It is stated in the note referred to, that the centre of the raisin industry is a comparatively small section along the Murray River at the point where the States of Victoria, New South Wales, and South Australia meet. This area has been transformed by irrigation into one of the richest in Australia, and it is intended to farther extend it. The work will, no doubt, receive great assistance from the new Murray River irrigation works, now being constructed jointly by the Governments of the above mentioned States.

Co-operation in the industry has not been confined to organized and semi-official institutions, but, it is said, includes the friendly assistance of one settler to another in his own particular problems. Ninety-five per cent. of the growers of fruit market their products through the Australian Dried Fruits Association, which has adopted the trade-mark 'sun-raysed', under which all the dried fruit is sold. A large amount of money is being spent annually by the Association in advertizing. The money required for this purpose and other expenses is raised by a small levy upon growers, on a production basis. This charge, it is stated, has been made up many times by the higher prices obtained for the dried fruit put systematically on the market under the title 'sun-raysed.'

For the season ended March last, official figures show a total production in eighteen districts under the jurisdiction of the Australian Dried Fruits Association of approximately £2,000,000 worth of dried fruits, of which two-thirds were raisins, and the remainder currants. It is added that areas being planted, to be in bearing by 1924, will, in all probability, cause an increase of at least 50 per cent. on the foregoing figures.

West Indian Leaf Mildew of Cotton

The fungus causing the leaf mildew of cotton in the West Indies has now been identified as belonging to the genus *Ovulariopsis*, Pat. and Har., and is described by Miss Wakefield as a new species, *O. Gossypii*, Wakef., in the current number of the *Kew Bulletin of Miscellaneous Information* (No 7, 1920)

A similar mildew occurring on leaves of the white cedar (*Tecoma leucoxylon*) is described as *O. obclavata*, Wakef.

Reasons are given for regarding these two forms as distinct from previously described species, which have been referred by Salmon to the conidial stage of *Phyllactinia corylea*

The Cultivation and Preparation of Cacao.

The *Bulletin of the Imperial Institute* of Great Britain for January-March 1920, contains a general article on the cultivation and preparation of cacao from the pen of A. H. Kirby, Assistant Director of Agriculture in the Southern Provinces of Nigeria, and formerly Scientific Assistant on the Staff of the Imperial Department of Agriculture for the West Indies.

The article is arranged under several heads. The first part includes a discussion of climatic considerations, the use of wind-belts and shade trees, the soil and situations suitable for cacao cultivation, methods of propagation, transplanting and pruning, the weeding, tillage, drainage and manuring of cacao lands, and the methods of harvesting the crops as practised in well established cacao districts.

The second part of the article deals with the fermentation and drying of cacao. Herein is given a comprehensive account of the fermentation process with some details of the methods used in drying the fermented beans.

The third and last part of the article contains a list of insect and other animal pests together with a list of fungi which attack the cacao plant.

INSECT NOTES.

A COCOON-SPINNING THRIPS IN SURINAM.

Under the title of 'Cacao Thrips in Surinam', an article in the *Agricultural News* for July 24, 1920, (p. 234) gave the salient features contained in a pamphlet on the subject, issued by the Agricultural Department, Surinam.

In another pamphlet issued by the Entomological section of the Surinam Agricultural Department entitled 'A Cocoon-spining Thrips', by A. Reijne, an account is given of two species of thrips which are predaceous on the cacao thrips.

The cacao thrips (*Heliothrips rubrocinctus*, Giard.) is a pest well known in the cacao-growing districts in the American tropics, and in certain other tropical localities where this crop is grown.

Two other species of thrips, *Franklinothrips tenuicornis*, Hood, and *F. vespiformis* Crawford, are now reported as natural enemies of the cacao thrips, but up to the present time these occur in such small numbers that they are not of great importance in the control of the pest.

This pamphlet has for its object the recording and describing of the cocoon-spinning habit of these two species of thrips. Thrips do not usually spin a cocoon in which to pupate, in fact, the author of the paper refers to this as 'the most peculiar habit, which to my knowledge has never been described in the case of Thysanoptera, is the spining of a cocoon before pupation'. In a note added at the end, however, Mr. Reijne states that he later came across, in a review of a Russian publication, a reference to the spinning of a cocoon in another species, *Aeolothrips fasciatus*.

H.A.B.

DORMANCY IN SEEDS.

The problem of dormancy in seeds is probably one of the most perplexing in the whole of plant physiology. It is common knowledge that many seeds, after detachment from the parent plant, pass through a period of rest, during which they fail to germinate even under the most favourable conditions of moisture, and oxygen supply, and temperature. Such seeds can often endure the withdrawal of water and dry up, remaining alive sometimes for many years. It is obvious that such seeds cannot be described as dead, since they may retain their capacity for germination for several years. A seed may fail to germinate immediately after harvesting, owing to a state of dormancy in the embryo itself or because of the nature of the seed-coats. The dormancy in the embryo, is due to the need of further ripening processes, which may conveniently be designated after-ripening. More usually, however, the dormancy is due to the seed-coats, which may prevent germination by inhibiting the absorption of water, or mechanically preventing the expansion of the embryo. The seed-coats may also prevent germination by interfering with the absorption of water, or the elimination of carbon dioxide. Soaking in acids is often effective in forcing such seeds, either through modifying the colloids of the seed-coats or changing the reaction of the embryo. Other forcing agents which are often successful in shortening the period of dormancy are freezing, exposure to high temperatures, desiccation. It is interesting to note that Johnson grass (*Holcus halepensis*) germinates best after exposure to alternating temperatures, whereas the closely allied Sudan grass (*Holcus halepensis sudanensis*) requires a constant temperature; while removing the pulp from camphor seeds may hasten germination of these seeds by two weeks.

Some observations of Kondo on the after-ripening of rice may be of interest. The rice was harvested at intervals in its growth designated as the milk, the yellow ripe, the fully ripe, and the dead ripe stages. Seed harvested in the milk stage was found viable, but to be lacking in vigour. Storage for about fifteen days after preliminary drying, or for a month without drying, resulted in quite satisfactory germination. The germination of the yellow ripe grain was also markedly improved after from one to three months storage. Fully ripened grain germinated quite well immediately after harvest, but showed greater viability a month later. Dead ripe grain germinated very readily immediately after harvest, and was not materially benefited by storage. Grain stored in a dry condition completed the ripening process much more rapidly than that stored without preliminary drying, but the latter showed greater viability and vigour. The storage of the unripe grain in the panicle was found to be detrimental in many cases to after-ripening.

Information of this nature is clearly of the greatest value it is to be regretted that more information is not available concerning the behaviour of West Indian seeds. The possibility should not be overlooked, however, that some of the seeds of these islands may pass through a period of secondary dormancy. That is to say, the seed may be capable of germination immediately after harvesting, but may subsequently pass into a quiescent period, after which it may again be viable. The loss of vitality in seeds is of course a matter of the greatest importance. Rubber seeds for instance, very rapidly lose their viability, thus rendering their transport from one country to another extremely precarious.

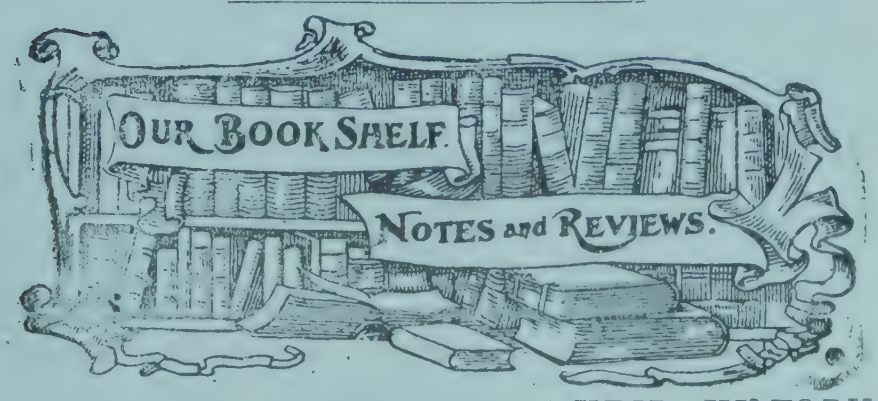
T.G.M.

LONGEVITY IN SEEDS.

Some useful information concerning the longevity of the seeds of some of the commoner crops of the temperate regions has lately been published by the Seed Branch of the Canadian Department of Agriculture. The seeds were stored in cotton sacks which were kept at ordinary room temperature in a galvanized iron chest with a lid. Once a year in late summer they were tested for germination. The records thus permit a comparison of their viability after various lengths of time in storage. The viability of wheat remained constant for six years and then gradually decreased till about the end of the eleventh year, when a very rapid diminution in viability took place till the fifteenth year, when germination ceased. The viability of oats, on the other hand, increased for about six years, and then gradually fell till it was below zero after twenty years. It would be exceptionally interesting to have information of this sort for the various strains of cotton which are cultivated in the West Indies. It appears the longevity of certain seeds may be greatly prolonged by desiccation. Thus Becquerel has endeavoured to find out whether or not there may be an entire suspension of vitality. He first found that dried seeds of various kinds, on being placed in pure and dry nitrogen for a year, did not liberate a trace of carbon dioxide, and yet germinated subsequently. He then showed that grains of wheat, after perforation of the seed-coats, and desiccation for one year, could be exposed for seventy-seven hours to the temperature of liquid hydrogen

(253°C.), and that nevertheless they retained their power of germination. He concluded from his experiments on certain seeds that an interruption of life is not only possible, but actual, without their being any indication of a limit to its prolongation. These considerations should be of the first importance to those whose business lies in the handling of seeds.

T.G.M.



COCOA AND CHOCOLATE THEIR HISTORY FROM PLANTATION TO CONSUMER. By Arthur W. Knapp, B.Sc, F.I.C., *Chapman and Hall Ltd.*, London, 1920. Price 12*s.* 6*d.* net.

The author, who is the Research Chemist to Messrs. Cadbury Brothers, Ltd., has produced a charming small book dealing with the history of cacao, its cultivation and manufacture, for the instruction of the general reader; he has succeeded in conveying in a small compass a vast amount of information in a very lucid style. As the author says in his preface, the industry with which this book deals is in process of change from an art to a science. There are many indications of scientific progress in cacao cultivation, and an increased amount of scientific knowledge of cocoa and chocolate manufacture.

Besides the introduction, the book consists of ten chapters, each of which deals concisely, and in an interesting way, with some particular point of the subject.

In the introduction the derivation of the terms cacao, cocoa, and chocolate is traced, and Mr. Knapp properly defines the three terms as follows:—

Cacao refers to the cacao tree, the cacao pod, or the cacao bean or seed. By the single word cacao is implied the raw product in bulk.

Cocoa refers to the powder manufactured from the roasted beans by pressing out part of the butter.

Chocolate signifies any preparation of roasted cacao beans without abstraction of butter. It practically always contains sugar, and is generally prepared in moulded form.

It is interesting to note that this word is really the result of a printer's mistake. According to Mr. W. J. Gordon, the word used by a Spanish writer, Joseph Acosta, as early as in 1604 was 'choc l-tl', the Mexican name for the beverage prepared from the cacao bean. The printer of his book, however, made him write chocolaté, from which the English eliminated the accent, and the French the final letter.

Chapter I is a short sketch of the history of the cacao bean from the time of the ancient Mexicans up to the present date. It is worth noting that cacao was used by the Aztecs not only for the preparation of a beverage, but as a circulating medium of exchange.

The cacao tree and its cultivation is the subject of the interesting Chapter II, in which the author emphasizes the importance of the foundation of agricultural colleges and research laboratories in tropical regions, for scientific investigation of the problems connected, not only with the cacao industry, but with other tropical products.

Chapter III deals with the harvesting and preparation for the market of the cacao beans. In this the process of fermentation, and the changes caused thereby in the interior of the cacao bean are clearly described, and the advantage of proper fermentation is pointed out.

The world's production of cacao, and the manner in which it is sold in the great cacao markets, are dealt with in Chapter IV. Although it is stated that Venezuela, probably the original home of the plant, produces the finest cacao in the world, praise is given to Trinidad, Grenada, and Ceylon for their scientific method of culture and production. The story also of the wonderful growth in cacao cultivation on the Gold Coast within the last few years is brought into prominence. In 1891 there were only 80lb. of cacao produced on the Gold Coast; this had risen in 1919 to 177,000 tons, valued at £8,000,000, or in other words, 40 per cent. of the world's production of this crop. It is interesting to note that in 1918 nearly half of the world's supply was produced within the British Empire.

The next two chapters deal with the manufacture from the crude cacao bean of cocoa and chocolate. Full descriptions are given of the various machines and processes employed nowadays in producing from the raw and somewhat astringent cacao bean, the nutritious and delightfully flavoured articles of food known as cocoa and chocolate.

The by-product of the industry, namely cacao butter and cacao shell, and the uses to which they are put, form the subject of Chapter VII. By cacao butter is meant the vegetable fat which is partly expressed from the cacao beans during the process of manufacturing them into cocoa. This is used for many purposes, not only as an edible fat in making biscuits and confectionery, but also for the preparation of ointments and pomades, and other pharmaceutical preparations. By cacao shell, the author means the thin outer covering or husk of the bean, which is separated from it when roasted by winnowing machines. Although this by-product has been used for the preparation of inferior grades of cocoa, its chief value is to cattle food makers, as it has been found to be of considerable food value, although it is said to be unwise to put a very high percentage of cacao shell in cattle food.

Chapter VIII deals with the composition and food value of good cocoa and chocolate. During the war chocolate was highly valued for army rations as a compact foodstuff, which is easily preserved. There are a number of records of men whose lives have been saved by means of a chocolate ration

In Chapter IX a plea is presented for legal definitions which would tend to prevent the adulteration of cocoa and chocolate, which is unfortunately too common.

The book concludes with Chapter X, in which the consumption of cacao in the various countries of the world is compared, and the great growth in the world consumption is shown in several tables.

The bibliography attached to the book appears to be most comprehensive. It would seem as if in the list of books, mention is made of every one written in any European language on the subject of cocoa and chocolate from the year 1600 to the year 1919.

A useful index concludes the volume, which is profusely and excellently illustrated, and splendidly printed.

To any person interested in the subject, the book will certainly prove a treat. It has seldom happened that the reviewer has been able to praise a book of the kind, written for the general reader so wholeheartedly, both with regard to manner and matter.

GLEANINGS.

A note in *United Empire*, August 1920, states that there is at present a boom in the coal trade of the Union of South Africa The output for March this year was the most valuable ever known in the history of the country, it being a little short of 1,000,000 tons, valued at pit's mouth to £375,006. In addition to the long standing market in the East and Egypt, there is now great demand for this coal in several continental countries, and in South America.

The cinnamon tree has been introduced into the Gold Coast, and is being cultivated experimentally at the agricultural station of the Colony. Samples of the bark, forwarded for examination to the Imperial Institute, were found to be of very good quality, giving a high yield of oil. The cultivation of cinnamon bark in the Gold Coast on a commercial scale therefore appears to be worth consideration. (The *Perfumery and Essential Oil Record*, September 1920.)

According to a note in *United Empire*, September 1920, Mauritius, like many other sugar producing countries, has in late years amassed great wealth, owing to the high prices obtaining for this commodity. The prosperity of the sugar industry is said to be phenomenal, and it is estimated that more than Rs.200,000,000 will, in all probability, be received for sugar during the coming season. This, added to the wealth of the last three years, makes Mauritius, for its size, one of the wealthiest countries in the world.

Trade statistics of the United States of America for the fiscal year 1920, the first subsequent to the war, show a great increase in the imports and exports over those for the fiscal year 1914. the last preceding the war. According to the *English Speaking World*, August 1920, the imports, as a whole, for the fiscal year 1920, show an increase of 177 per cent. over the fiscal year 1914, the figures being, respectively, $5,239,000,000 and $1,894,000,000. The exports for 1920, which stand at $8,111,000,000, show an increase of 243 per cent against $2,365,000,000 for 1914.

To increase the yield of cane in Louisiana, planters are beginning to realize that they must bury all the pea vines possible. It has been found that where all or most of the peas are raked for hay in a three-year cropping system—viz., (1) plant cane, (2) stubble cane, (3) corn and peas—high production of cane per acre cannot be maintained, even if fertilizers are abundantly used. In fact, the ploughing under of all the peas in a three-year system will not give as high yields as are obtained under the four-year system of (1) plant cane, (2) stubble cane, (3) velvet beans and corn, (4) corn and peas. (*Facts About Sugar*, September 11, 1920.)

With aview to preventing sugar planters in Guadeloupe and Martinique from converting their cane juice into alcohol rather than sugar, the French Government has adopted regulations controlling the importation of these into France by a preferential tariff. *Facts About Sugar*, September 11, 1920, states that cane growers in the French colonies are tempted to produce alcohol in preference to sugar, owing to the fact that a kilogram of sugar on distillation will yield 90 centilitres of alcohol, for which can be obtained from 3 to 5 francs a litre, while the same quantity of sugar will only realize one franc. It is estimated, however, that despite this inducement, the sugar output of the French Antilles will be in the neighbourhood of 50,000 tons for the next season.

About 5,600,000 lb. of turpentine are produced annually in Greece, being extracted from pine resin, which on distillation yields 20 per cent. of the essence. Before the war Greece exported to Hamburg alone some 1,000 tons annually, which was employed in the preparation of synthetic camphor. During the war however, this turpentine formed the basis of a new industry. By mixing 80 to 90 per cent. of turpentine with 10 to 20 per cent. of ether or alcohol, there was manufactured a product known as 'motorine,' which supplemented with some success the use of benzene in army motor cars. Another product known as 'thaline' was also made for substituting petroleum as an illuminating material. (*Weekly Bulletin, Department of Trade and Commerce*, Canada, September 6, 1920.)

A recent writer in a German exchange points out the folly of the Government in curtailing the sugar beet industry in Germany, and also shows how it has affected other industries like wheat. This writer states that from one hectare of land, Germany is capable of getting 1·68 tons of wheat, 19·30 tons of beets or 2·76 tons of sugar. One ton of sugar exported is valued at 20,000 marks, with which 3·2 tons of wheat can be purchased. Again, a good beet field will produce 5·2 tons of wheat. To export 1,000,000 tons of sugar, it is necessary to have 362,000 hectares of land. From this acreage only 600,000 tons of wheat can be produced, whereas by raising beets, Germany can export sugar and procure 3,200,000 tons of wheat. (The *Louisiana Planter*, September 11, 1920.)

All previous records for the consumption of sugar on the part of the American people were broken during the first six months of 1920, states *Facts About Sugar*, September 4, 1920. Figures for production, importation, and exportation, compiled by the Bureau of Foreign and Domestic Commerce at Washington, for the fiscal year ended June 30 last, give the net amount of sugar retained for consumption in the United States during this period as 4,340,156 long tons. The latest estimate by the Census Bureau, based on the returns of the 1920 census, puts the population of the country at approximately 105,000,000, this gives a per capita supply for the fiscal year of about 1¾ lb. per week. This in itself is an increase over the previous fiscal year of approximately 20 per cent. Further figures show, however, the consumption per head per week for the first six months of the present year to be almost 2 lb., as against 1·6 lb. for the same period in 1919.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. Work in the Experiment Stations and Botanic Garden during the month of Septemper was chiefly of a routine nature. The onion seed imported in August 1919, and stored over calcium chloride, is now giving a viability of 30 to 50 per cent, according to notes forwarded by Mr. R. O. Williams, the Superintendent of Agriculture. Plant distribution during the month comprised the following: coco-nut plants 254, budded oranges 20, budded grape fruits 5, grafted mangoes 25, grape plants 3, ornamental 87, economic 2, cuttings 25, and 1lb. of onion seed. Regarding staple crops, corn is commencing to ripen and gives promise of a good crop Small pickings of cacao are being made, but the main crop is late. There is, however, promise of a fair crop. Thrips is reported from several localities, but as yet the attacks are not wide spread. The Agricultural Inspectors report considerable damage to corn by rats. The rainfall at Richmonp Hill during the month was 7·61 inches. Special efforts were made by the officers of the Department, in co-operation with the Public Works Department, to put the grounds of Government House in proper order for the arrival of H.R.H. the Prince of Wales on September 24.

DOMINICA. Planting operations were performed in the Experiment Stations and nurseries during the month of September. The crop of limes reaped from the lime experiment station during the six months ended September 30, Mr. Jones states, amounted to 1,340½ barrels of fruit, all which were sold in the local market, and realised the sum of £458. 9*s*. 3*d*. Of the above 55½ barrels were sold as green limes early in the season, and these averaged 19*s*. per barrel. The remainder, 1,285 barrels of fruit, sold as ripe limes, at an average rate of 6*s* 3¾*d*. The average price obtained for the half-year's crop was 6*s*. 10*d*, per barrel of limes. Concerning the staple crop, it is mentioned that the local rate paid for ripe limes during the month dropped from 6*s*. to 5*s*. 6*d*. per barrel, and that for raw lime juice from 9*d*. to 8*d*. per gallon It is reported that little demand exists for concentrated lime juice in London and New York. Consequently prices for this product are on the down grade. During the month plant distribution comprised: lime plants 4,825, cacao 100, budded citrus 60, grafted mangoes 11, nutmegs 2, miscellaneous 30, making a total of 5,028 In addition, 150 shade tree cuttings, and 700 sugar-cane cuttings, were sent out, and 154 packets of vegetable seeds were sold. Heavy squalls were experienced between September 13 and14. On the whole, however, the weather during the month was fine. The rainfall registered for the month was 8·60 inches.

H. R. H. the Prince of Wales and suite motored through the Gardens during the afternoon of Sunday, September 26th

ANTIGUA. Plant distribution for the month of September included: 82,500 sweet potato cuttings, 389 lb black eye peas, 10lb Barbuda beans, 3 grafted oranges. 1 lb onion seed, 5, miscellaneous plants. In addition, 311 lb of cotton-seed were sold, making the total quantity sold to date 4,438 lb. Work in the Experiment Stations and Botanic Garden was of a routine nature. In regard to staple crops, the Curator, Mr. F. G. Harcourt, states that the sugar-cane crop throughout the island is still very backward, especially the ratoon fields. The young cotton crop in most districts is improving steadily under the influence of light showers. Much difficulty is being experienced in establishing fields of this crop. Towards the close of the month the stock of selected cotton seed was exhausted. This shortage was met by the importation of 500 lb of cotton seed from Barbuda. This seed was originally obtained from Antigua, for planting their last season's crop. Slight attacks of cotton caterpillars have been experienced in several districts, but this pest is being held in check, by dusting with Paris green and lime. Cotton stainers were found in one locality under a mahoe tree, but have not yet appeared in cotton fields. Much assistance was given by the Agricultural Department to the Decorative Committee in conexion with the visit of H. R. H. the Prince of Wales. Mr. F. G. Harconrt the newly appointed Agricultural Superintendent and Curator, arrived in the Presidency and assumed his duties on September 18. Several visits were made to Sawcolts Land Settlement by the officers of the Department. The rainfall recorded for the month was 4·47 inches. The total precipitation for the year to date was 20·50 inches. A thunder storm of moderate violence was experienced on September 30.

A short report on agricultural instruction for the month of September, appended to the foregoing notes, records visits to peasant holdings in certain districts, and advice given in connexion with measures for combating attacks of cotton stainers, which were observed feeding on seeds of a mahoe tree. Smaller yields were obtained from the Indian corn crop than were expected on account of the dry weather experienced after planting.

ST. KITTS. The Agricultural Superintendent writes to say that the usual routine work was carried out in the Botanic Garden during the month of September. The rains at the end of August, which continued until the middle of September, improved the appearance of the cane crop and enabled artificial manures to be applied, but since the middle of the month dry weather has again set in, and the general condition of the crop is very unsatisfactory. The ratoons, especially in the Basseterre district, are very backward, and unless good weather is experienced during the next two months, the prospect of a crop for next season will be very poor. The cotton crop has considerably improved, and the prospects are decidedly good in the Valley district, and at Sandy Point. Picking has begun on the estates in this district, and there will soon be a large number of bales ready for sale. No price has yet been offered for either seed-cotton or lint. Cotton worms have appeared, but no damage has been done. At a meeting of the Agricultural and Commercial society, held during the month, a letter from the Imperial Commissioner of Agriculture relative to stimulating local production was discussed. The meeting was fully alive to the necessity of this, and it was agreed that all necessary steps would be taken to plant provisions. The rainfall for the month was 4·67 inches, for the year to date, 25·68 inches

NEVIS. Usual work in the Experiment Station is reported in notes received from the Agricultural Instructor, Mr. W. I. Howell, for the month of September. The following plants, seeds, etc, were distributed from the Botanic Station during the month: Indian corn 27½lb. sweet potato cuttings 500, Tonkin peas ½lb, Paris green 182 lb., limes 567lb. The sugar-cane crop has improved since the rains, but is poor, and even with heavy rains it is not likely that the crop will be anything worth while. The cotton crop throughout the island has made rapid progress, and if due care is exercised in controlling the worms, a good crop will be reaped. The cotton worm has appeared in many of the fields, but so far very little damage has been done. A supply of Paris green has been put in stock by the local Government, for the benefit of the smaller growers, and it is hoped that with this scheme working as in past years, the crop will be saved. A fairly large acreage was planted in provision crops during the month and this, on the whole, is doing well. The rainfall recorded for the month was 6·85 inches, for the year to date, the precipitation is 23·71 inches.

IMPLEMENTAL TILLAGE IN TRINIDAD.

(*Continued*)

The following is the continuation of the report by Mr. Joseph Verteuil on implemental tillage, the first part of which appeared in the previous issue of this Journal. It will be concluded in our next.

RATOONS.—FIELD 1,—ST. AUGUSTINE...11 ACRES.

Description of work.	Number of Labourers.	Number of Animals.	Cost of labour.
		Mules.	$ c.
Cultivating middles lengthways with 'one mule' plough : making two cuts. The work was performed in 4¾ days by a man and a boy with one mule	9·50	4·75	3·27
Pulverising lengthways with horse-hoe up and down. The work was performed in 5¼ days by a man and a boy with one mule ...	10·50	5·25	3.08
Total for 11 acres ...	20·00	10·10	6·35
Per acre	1·82	0·91	0·58
Derpeciation of implements ...	...	...	·06
Hauling trash in drain by hand labour, 4·95 tasks per acre, at 30 cents	4·95	...	1·48
Extra feed of mules at 28 cents...	...	...	·25
Weeding unworked portion of land, cleaning canes, tools, drains, and respreading trash from drains by hand labour, 14·14 tasks per acre at 30 cents	14·14	...	4·24
Total per acre ...	20·91	0·91	6·61

The horse-hoe was passed over the 5 acres of third ratoons a second and a third time at an interval of fifteen days, and at a total cost of about 44c. per acre for each additional operation, and this is likely to save a subsequent weeding.

The cost and number of labourers required per acre to work these 11 acres by hand is as follows :—

Description of work.	Labourers.	Cost.
		$ c.
Hauling trash—11 tasks at 30 cents	11·00	3·30
Forking and burying trash—13·2 tasks at 40 cents	13·20	5·28
Total per acre ...	24·20	8·58

As will be seen from the tables above, to work an acre of ratoon canes it takes 20·91 labourers and 0·91 mule at a cost of $6·81 as against 24·20 labourers at a cost of $8 58 by hand—a saving of 3·29 labourers and $1·97 per acre in favour of implemental tillage. If the forkers did a task and a half there would be a difference of 0·91 labourer in favour of hand labour, but as previously pointed out, forkers are only available in limited numbers. A saving of 2·36 labourers and 71 c. per acre is also obtained on the subsequent weeding as mentioned under plant canes.

RATOONS.—CULTIVATING FLAT AND MOULDING THE CANES. In Field 5 St. Augustine, 2nd ratoons, the canes were cut in April and 6·30 acres were worked as follows :—

2ND RATOONS—FIELD 5, ST AUGUSTINE, 6 30 ACRES.

Description of work.	Number of Labourers.	Number of Animals.	Cost of labour.
		Mules.	$ c.
Cultivating lengthways with 'one mule' plough making two cuts. The work was performed in 3 days and half an hour by one man and a boy with one mule ...	6·11	3·00	2·45
Pulverising lengthways with horse-hoe up and down. The work was performed in 2 days 2½ hours by one man and a boy with one mule	4·58	2·29	1·47
Moulding with celery hiller or double mould board plough. The work was performed in one day 6½ hours by one man and a boy with one mule	3·44	1·72	1·38
Subsoiling bottom of drills with horse-hoe up and down. The work was performed in two days 6 hours by a man a boy with one mule	5·34	2·67	1·80
Total for 6·30 acres ...	19 47	9·74	7·10
Per acre	3·09	1·55	1·13
Depreciation of implements ...	...	...	·15
Hauling trash in drain by hand labour, 3·87 tasks per acre at 30 cts.	3·87	...	1·16
Extra feed of mules	..	...	·43
Weeding unworked portion of land, cleaning cane stools, drains and respreading trash from drains. 17·40 tasks per acre at 30 cents...	17·40	...	5·22
Total per acre ...	24 36	1·55	8·09

The horse-hoe was passed a second time on June 27-28 at a total additional cost of 44 c. per acre.

The cost and number of labourers required per acre to work these 6 30 acres by hand is as follows :—

Description of work.	Labourers.	Cost.
		$ c.
Hauling trash—12·43 tasks at 30 cts.	12·53	3·73
Forking and burying trash—14·52 tasks at 40 cents	14·42	5·81
Total per acre ...	26·95	9·54

From the above it will be seen that notwithstanding the additional operations of moulding the canes and subsoiling the drills, it would take 2·59 labourers less and cost $1·45 less per acre to work with implements, to which must also be added 2·36 labourers and 71 c. per acre saved on the subsequent weeding as previously pointed out.

BREAKING LAND, FILLING OLD DRAINS, AND LEVELLING TO REFORM BEDS.

Part of Field 3 Valsayn, 2·73 acres from which the canes were cut was worked in April as shown below. The small drains were not more than 2 feet deep, and the surface of the beds fairly flat, so that no supplementary hand labour was required.

BREAKING LAND AND REFORMING BEDS—FIELD 3 VALSAYN —2·73 ACRES.

Description of work.	Number of Labourers.	Number of Animals.	Cost of labour.
			$ c.
Ploughing and uprooting old cane stools with No. 9 'two mule' plough. The work was performed in 7 days by one man and 3 boys with 4 oxen	28 00	28·00	8·75
Re-ploughing to fill drains with No. 9 plough. This work was performed in 3 days by 1 man and 3 boys with 4 oxen	14·00	14·00	3 07
Harrowing and levelling with 'spring teeth' harrow. The work was performed in 6 days by one man and 2 boys with 3 oxen	19·50	13·00	5·48
Total for 2·73 acres ...	61 ·50	55·00	17·30
Per acre	22·53	20·15	6·34
Depreciation of implements ...	...	...	·04
Extra feed of oxen	...	...	5·34
Hauling trash in drains to clear beds for ploughing--4·98 tasks at 30c.	4·98	...	1·49
Total per acre ...	27·51	20·15	13·26

The cost and number of labourers required per acre to work these 2 73 acres is given in the table below :—

Description of work.	Labourers.	Cost.
		$ c.
Hauling trash—4·98 tasks at 30 cts.	4·98	1·49
Stumping out cane stools, filling drains and levelling—25·88 tasks at 40 cents	25·88	10·35
Total per acre ...	30·86	11·84

As the cost and number of labourers required to perform the preparatory work of hauling the trash into the drain to clear the land for the implements and hand labour are identical, the figures relating to this item need not be taken into consideration. It will then be seen that it takes 22·53 labourers at a cost of $11·77 to level off an acre of land with implements as against 25 88 or 17·25 labourers at a cost of $10·35 according as the men digging out the stools and levelling work one or one and a ha'f tasks a day. When the work is done with implements the soil is left in better tilth, being more loose and friable, than when done by manual labour. In Field 3, St. Augustine, the small drains were nearly 3 feet deep, and beds 'turtle backed' so that a certain mount of supplementary hand labour was necessary. The whole field consists of 10·77 acres of which 0·61 acre was levelled exclusively by hand labour as a comparison. This field had previously been ploughed at the end of the dry season, and the reploughing and levelling was done in September.

REFORMING BEDS AND LEVELLING—FIELD 3, ST. AUGUSTINE—10·16 ACRES.

Description of work.	Number of Labourers.	Number of Animals.	Cost of labour.
			$ c.
Reploughing with Nos. 9 and 12 ploughs and filling drains. The work was performed in 20¾ days by a man and three boys with 4 and sometimes 6 oxen to each plough...	83·00	96·00	28·14
Harrowing and leveling with Morton's ditcher, the spring teeth and local made harrow. The work was performed in 15¼ days ...	49·00	47·59	15·52
Total for 10·16 acres ...	132·00	143·50	43·66
Per acre	12·99	14·12	4·30
Depreciation of implements ...	...	...	·18
Extra feed of oxen	...	...	3·74
Supplementary hand labour ...	1·34	...	·54
Total per acre ...	14·33	14·12	8·76

On 0·61 acre actually worked by hand labour, it is calculated that 24·6 men would level an acre at a cost of $9·84, as the men only worked a task a day. This shows a gain of 10·27 labourers and $1·08 per acre in favour of the implements.

(To be Concluded.)

A notice appears in the St. Vincent *Government Gazette* September 23, 1920, stating that the Government Cotton Ginnery will purchase prime cotton seed at $20 per ton and 1,7000 tons manure returned to vendor, or at $50 per ton and no manure returned. In both cases all bags will be returned to vendor. Corn will also be purchased at the Government Cotton Ginnery, the following prices were paid on account: shelled corn, $2·50 per 100 lb., and cob corn, $1·75 per 100 lb.

MARKET REPORTS.

London.—The West India Committee Circular. September 11.

Balata—Venezuelan Block, no quotations; West Indian Sheet, 4*s.* 3*d.* c.i.f., spot, 4*s.* 6*d.*
Beeswax—No quotations.
Cacao—Trinidad, 89*s* Grenada, St. Lucia, Dominica, and Jamaica, no quotations.
Copra—£58.
Honey—65*s.* to 90*s.*
Lime Juice—Raw, 3*s.* to 3*s.* 6*d* per gallon; Concentrated, no quotations.
Pimento—4*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs T. S. Garraway & Co., October 13.

Arrowroot—$8·00 per 100 lb. duty paid.
Cacao—Lottings at $17·00
Coco-nuts—$65·00 husked nuts.
Hay—Sales at $6·00.
Onions—Lottings at $6·00
Peas, Split—No quotations; Canada, $13·00 small, $17·00 large.
Potatoes—Sales at $8·00.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, September 21.

Bay Oil—30*s.* per lb. spot, and 28*s* forward.
Lime Oil—6*s.* for West Indian distilled, and for hand-pressed 26*s.* per lb.
Orange Oil—West Indian, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., October 6.

Cacao—Venezuelan, $18·50.
Trinidad, $17·25 to $17·75.
Coco-nut Oil—$1·95 per gallon.
Coffee—Venezuelan, 16c. to 17c. per lb.
Copra—9c. per lb.
Dhal—No quotations.
Onions—$8·75c. per 100 lb.
Peas, Split—$8·75 per 100 lb.
Potatoes—English. 8 to 10c. per lb.
Rice—Yellow, $14·50. White, no quotations.
Sugar—No quotations.

New York.—Messrs. Huth, Gillespie & Co., Inc, September 15.

Cacao—Caracas, 14c. to 14½c.; Grenada, and Trinidad, 13c. to 14c.; Jamaica, 10c. to 11c.
Coco-nuts—Jamaica selects, $55·00 per M; Trinidad 52$·00 per M; Jamaica, $35·00; Trinidad $30·00 per Mculs
Copra—7¾c.
Coffee—Jamaica, 10c. to 13c. per lb.
Ginger—34c. to 38c. per lb.
Goat Skins—Jamaica 70c, Antigua, Barbados, St. Thomas and St. Kitts 65c.
Grape Fruit—Jamaica, $3·00 to $5·00 per box.
Limes—$6·00 to $8.00 per bbl.
Mace—26c. to 28c.
Nutmegs—17½c.
Oranges—$5·00
Pimento—7½c. per lb.
Sugar—Centrifugals, 96°, 10c.; Muscovados, 89°, 9c.; c. & f., Molasses, 89°, 9c.

Special Selected Sea Island Cotton Seed

— FOR —

PLANTING PURPOSES.

We can supply you with the above, selected from Seed grown at the Government Industrial Schools, and the Lunatic Asylum Farm, under the supervision of the Agricultural Department. Lint from this Seed has been highly reported on by the Spinners in England.

WE SOLICIT YOUR ORDERS.

The Barbados Co-operative Cotton Factory, Ltd.

WHITE PARK.
May 15, 1920.

AGENTS FOR PUBLICATIONS OF THE IMPERIAL DEPARTMENT.

London: Messrs. Dulau & Co., Ltd., 34-36, Margaret Street, Cavendish Square, W.
West India Committee, 15, Seething Lane.
Barbados: Advocate Co., Ltd., Broad Street, Bridgetown.
Jamaica: The Educational Supply Company, 16, King Street, Kingston.
British Guiana: The Argosy Co., Ltd., Georgetown.
Trinidad: Messrs. Muir-Marshall & Co., Port-of-Spain.
Tobago: Mr. C. L. Plagemann, Scarborough.
Bahamas: Mr. N. D Sands, Board of Agriculture, Nassau.
Grenada: Messrs. Thos. Lawlor & Co., St. George
St. Vincent: Mr. Floris Simmons, Experiment Station.
St. Lucia: Mr. R. W. Niles, Botanic Station.
Dominica: Mr. W. G. Hutton, Botanic Garden.
Montserrat: Mr. W. Robson, Botanic Station
Antigua: Mr. S. D. Malone, St. John's.
St. Kitts: The Bible and Book Supply Agency, Basseterre.
Nevis: Mr. W. I. Howell, Experiment Station.
Canada: Lewis W. Clemens, 801, Yonge Street, Toronto

AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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Commercial and Industrial Exhibitions.

ALTHOUGH exhibitions, in the sense of the word as at present understood, are a comparatively modern development, the idea underlying the term seems to have existed from very early times in European civilization. The origin of exhibitions was doubtless in the local fairs which seem to have played a great part in the industrial and social life of madieval Europe. At these fairs, usually held annually in country towns, met the artizans and farmers of the neighbouring district, offering for barter or sale specimens of their crafts, or samples of their produce, which the merchants of the town could inspect and bargain for.

In process of time as facilities of transport were improved, some of these local annual fairs grew to large proportions especially in Central Europe. The case of Nijni Novgorod in Russia may be instanced where traders and producers in tens of thousands met from distant regions at the world-famous fair on the banks of the Volga.

In the middle of the last century was evolved the conception of a universal fair, where the products and industries of all nations might be exhibited, it was hoped to their mutual advantage, and to the furtherance of general peace. The first of these it may be remembered was held in London, in 1851, of which the Crystal Palace still remains as a memorial. Since then such universal exhibitions have been held from time to time in the great cities of almost all the nations.

As an outcome of this there has still more lately arisen, what one may consider a reversion to the older idea of the fairs, in the form of frequent, if not strictly annual, commercial and industrial exhibitions in business centres, which are meant to further commerce, and to encourage production; especially is this so in such exhibitions held in Canada, for instance.

From an educational point of view such exhibitions are of great value, as can easily be understood. Visitors learn from actual observation the nature of the products and resources of various other parts

of the Empire, and also the extent of its manufactures, and the various kinds of machinery used in their production.

Still, the educational advantages cannot be said to be the main object of such exhibitions, valuable as these advantages doubtless are. It must be remembered that the utilitarian point of view must necessarily be the primary reason for commercial and industrial exhibitions. The educational side can possibly be just as well, or even better, served by permanent museums. The business side, however, is paramount.

No country in the world under modern conditions is absolutely self-contained industrially with regard to its resources, and still more is this the case with regard to the various parts that go to make up an extremely complex entity like the British Empire. Every portion puts, so to speak, to every other portion the following questions: 'With what can you supply us, which we have not got, and which we want? and what do you want which we can supply? The business object of commercial and industrial exhibitions is to afford answers to these questions, and to enable those connected with commerce to be in a position to conduct trade to the mutual advantage of the places concerned.

From the above considerations it seems quite justifiable that public funds should be used to some extent for the purpose of providing an adequate guarantee for the success of an exhibition. The production of crops and the development of industries suited to special localities may well be stimulated, and the prosperity of the district much advanced, when a suitable and profitable market for the commodities is found.

Thus from time to time the Governments of the different West Indian colonies have granted subsidies for the purpose of affording a really representative exhibit on such occasions, both in England and in Canada, and it is well that this should be done. The idea of the mutual dependence of the various parts of the Empire on one another, and of the mutual benefit obtainable by the interchange of commodities with one another, is fundamental to the continued unity and prosperity of the whole.

What should be the aim then of exhibitors, say, from these West Indian colonies to such an exhibition like the annual one in Toronto, or the larger ones which are held from time to time in London and in other cities in Great Britain? In the first place, we want many things with which Canada for instance can supply us, such as flour and salt fish, and tinned food of various kinds, not to speak of machinery and manufactured foods—for the supply of these latter perhaps we look more satisfactorily to the mother country. Our Canadian brethren are sure to take care in future, as they have increasingly been taking in the past, to show us these products of theirs, and seek means to supply us with them. On the other hand they have need of all tropical products with which we can, and should, supply them. The obvious thing then is for each tropical colony to exhibit the tropical produce which may be at present available in sufficient quantity for commercial purposes, or which may possess possibilities of future profitable development by capital

To take some concrete instances. It would be most advisable that the established industries, the products of which must be sought in the tropics, such as sugar, cacao, and limes should be well and completely exhibited. Again, the possibilities of newer industries, such as coco-nuts and sisal, ought not to be forgotten, together with the revival of some others, such as coffee. Cotton too, which now so largely contributes to the prosperity of some of the smaller West Indian islands, should be adeqnately represented, especially at exhibitions held in London.

It would be quite possible to suggest other classes of exhibits which would be advantageous from the point of view of adding interest and attraction to the space allotted to any individual island, such as bright coloured seeds or handsome shells, not to speak of historic or pre-historic relics, etc. These, however, are merely subsidiary to the main purpose of a commercial and industrial exhibition. On such an occasion the efforts of exhibitors should be mainly directed to reflect the actual and potential industries of each place, so that when enquiries are made it may be possible to reply: 'Such and such things are produced, or can be produced in quantities large enough to justify export.' To devote very much attention to displaying what might be considered as only curios would be a mistake, although in some instances, the display of such things has led to the opening up of some trade in them. It may be instanced that a not inconsiderable sum of money now finds its way into Antigua from the trade which has sprung up between that island and the mother country in bead-work made from bright seeds and shells.

In conclusion it is most desirable that the West Indian colonies should be adequately represented by appropriate exhibits at commercial and industrial exhibitions within their reach, and no opportunity should be lost of taking advantage of such occasions.

ONE-WAY MOTOR-PLOUGHS.

In *The Times* Trade Supplement, August 28, 1920, attention is drawn to an interesting development in British agricultural engineering in the shape of the one way motor-plough. It is stated that such implements will soon make their appearance on the market on a commercial basis.

The one-way motor-plough has features which recommend it to all farmers whose arable land is divided into comparatively small areas, and also to those agriculturists who require to economize the space left at the headlands. One-way ploughing, moreover, is a simple procedure which unskilled labour can follow with little preliminary guidance, for there is no demand upon the operator to exhibit special skill in turning in a circumscribed area at the end of the furrow, and simultaneously to lift the plough out of work.

The reasons for the popularity of the one-way system therefore are obvious, and it is not surprising to learn that home and overseas inquiries for such an outfit are very numerous. Many large estate owners and farmers have made special, but vain journeys to England hitherto to try to secure one-way motor-ploughs, and have had to return with what is really the second best for their needs, viz. the self contained motor-plough or cultivator.

The one-way motor-plough in the present case consists of six plough shares, three being suspended from each end of the main carriage, which is modelled on the lines of a tractor body, and is driven by an engine sufficiently powerful to haul three furrows in the heaviest clay land. The forward shares are held out of work as the motor-plough proceeds across the fields, and automatically drop into work when the machine begins the return journey. Ploughing, therefore, becomes one succession of forward and return movements, and headlands are not required for turning

The one-way motor-plough, and another of similar design will compete at the Lincoln trials of the Royal Agricultural Society on September 28 and following days. As the two have never been in competition in public, or had their work compared with tractors, much interest will be shown in the meeting. The first-mentioned machine has the advantage that it can be used as a tractor to haul another implement or a laden wagon, for the ploughs can be removed.

ARTIFICIAL SELECTION.

In the Presidental address of Professor Trelease, which was delivered before the Illinois Chapter of the Society of the Sigma XI, May 19, 1920 there occurred a very striking passage which is reproduced in full below:—

Long before man began to find the products of organic nature profitable—indeed long before his appearance on the scene—plants had developed the power of making food and of applying it to their needs; and animals had acquired the habit of carrying its use into a much more dynamic field. The greatest tilth of this field is by man, the present culmination of the family tree of our living world; and what the struggle for existence among his more lowly relatives had produced that he could use, he has selected and favoured and modified to his greater benefit.

The strife between purposeful intelligence and productive capability, in which within limits the former is foreordained to dominate the latter, is not peculiar to human civilization and to the dominance of man over man: it reaches far into his relations with his fellow-creatures of lesser endowment. He has shaped them to his needs or fanciers very often in opposition to the selective law of nature; he has multiplied, at the expense of others, those that he fancied, and thereby increased the power of the earth to support human life and human activity far beyond its unaided capacity; he has become a potent factor in natural selection, and will continue operative as long as he does not kill the goose that lays the golden egg. It is significant that what he does not use, directly or indirectly, he commonly permits to exist through indolence or impotence rather than tolerance.

He knows that what he calls vermin are troublesome if not injurious. He protects himself and what he considers his property against them more or less consistently and completely; but in proportion to their power to evolve helpfully in harmony with conditions of life in the chinks and crannies of the world into which he can not or does not follow them, they escape and thrive not only despite him but at his expense and literally on him The rat is his uninvited guest the world over, and the gray rat, if he were worshipful and learned, would render daily thanks to the patron who has made him the rat of rats, transporting, housing, and feeding him to an almost unbelievable extent. Rust, smut, mildew and fermentative germ thrive under his régime; the world population of codling moth and chinch bug has enlarged a myriadfold through the ability of these self seeking creatures to get forward as riders on man's own self seeking progrese.

Perhaps in this survival and increase of parasites and other vermin lies the token that the earth and the fulness thereof are not to man; for if the Nature whose product he is permits his enemies to thrive and multiply notwithstanding his effort to protect himself, she gives in this permission a strong suggestion that his power is only an expression of her own power, and that while he sleeps and relaxes effort, her activity continues unabated along the line of peopling the earth toward its full capacity with a million forms of creatures to each one of which she offers the same fundamental problem as his own—perpetuation of the individual and of its kind, or restriction and disappearance, according to its fitness and adaptability under the conditions of the moment.

DEPARTMENT NEWS.

Miss E. M. Wakefield, F.L.S., Acting Mycologist on the Staff of the Imperial Department of Agriculture, left Barbados for Antigua, by R.M.S. 'Chaudiere', on October 27, for the purpose of investigations connected with her office From Antigua Miss Wakefield is expected to proceed to Dominica for the same purpose.

Mr. F. Hardy, M A., Chemist on the Staff of the Imperial Department of Agriculture, left Barbados for Dominica by R.M.S. 'Chaudiere' on October 27 on official duty.

SUGAR INDUSTRY.

SUGAR NOTES.

Facts About Sugar, Vol. XI, No. 12, September 18, 1920, contains an account of the papers read before the annual meeting of the Sugar Section of the American Chemical Society, which took place during mid September at Chicago. The following abstracts from some of the important papers read are reproduced from the journal above mentioned.

1. REFINING RAW SUGARS WITHOUT BONE BLACK BY C. E. COATES.

As the raw sugar campaign in Louisiana lasts only about three months, it is very desirable to utilize the expensive and well-equipped plants for refining raw sugars during the off season. Recently, market conditions have made this peculiarly attractive. But to avoid the necessity of expending half or three-quarters of a million dollars to equip a char house, special means of defecation have been resorted to to make white sugars out of native and Cuban raws.

With raws at 4c. per lb., a margin of 1c. per lb looks practicable for local refining, and with 18-cent raws, a 3-cent margin appears sufficient to provide a profit.

Light-coloured, large-grained sugars are the best for refining. Washing yielded 15 per cent. of green syrup of 85 purity, and the washings are preferably kept separate from these. The washed sugar of 98·5-99 purity, was melted in press and bag sweet water and defecated at 20 degrees Beaumé, being boiled in pans directly, without the use of multiple evaporators. For defecation, phosphitation or sulphitation or a combination can be used, or the Battelle process of boiling with lime and carbonating. Also, 15-18lb kieselguhr per ton of raw sugar has been used to great advantage, the press cake obtained being burned again. The residual carbon in it does no harm, and in fact helps the filtration, but removes no colour.

The best refining results have been obtained with decolourizing carbons, having 80-100 times the decolorizing power of char. Norit, ricehulls and Darco were the principal decolourizers used. Two to 4 per cent. of Norit on raw washed sugar was used and the mixture filter-pressed through the usual presses or through Danek presses. This Norit was recovered after 5, 3 and 2 uses, and later by washing with HCl, soda and water. After about ten such revivifications the Norit must go through the burning process. Thus about 0·9lb sugar was lost per 100lb sugar treated, and the green syrups gave up 50 per cent. of their colour. The yields on 95·5° to 96° sugars ran from about 88 to 91lb refined granulated to 100lb raw sugar treated. There is no inversion, and only careful control is needed to bring this work up to the theoretical yield figures.

THE CLARIFICATION OF CANE-JUICE WITHOUT CHEMICAL TREATMENT.

The following account is extracted from the paper read by Dr. F. W. Zerban of the New Orleans Sugar Experiment Station before the Sugar Section of the American Chemical Society in April 1920, and published in the *Louisiana Planter*, for September 25, and October 2, 1920.

The first part of the paper gives an outline of the methods heretofore used in clarifying cane and beet julces. Clarification by heat, by heating with lime, by carbination and by the use of phosphoric and sulphurous acids are first described in brief. The question is then raised as to whether or not these methods are essentially chemical. Noel Deerr showed that of the total impurities precipitated by the combined action of lime and heat, 28 per cent. are removed by the former, and 72 per cent by the latter agent. Of the 28 per cent. removed by lime, only a small fraction of the precipitated impurities are thrown down actually as calcium compounds. Thus the greater part of the impurities of cane and beet juices are precipitated by the action of heat in the clarification processes usually practised in modern sugar factories. The writer considers such ac ions to be mechanical rather than chemical, and comes to the conclusion that the mechanical aspect of clarification is much more important than the purely chemical.

The state in which the impurities occur in juices is next discussed. It is concluded that most of these impurities are present as colloidal particles, that is to say, as particles of too large a size to pass through the finest filters and therefore larger than true chemical molecules. During the last few years evidence has been accumulating in favour of the view that the whole subject of clarification should be reinvestigated from the standpoint of colloidal chemistry. Unfortunately we know very little at present about the colloids in cane juice. The proteins and polyphenols which cane juice contain are most probably in the form of colloidal particles, whereas the sugars and inorganic salts exist in true solution, in which they are present as molecules. Such impurities as particles of soil and of fibre are in suspension in cane juice and can easily be removed by filtration. Between all these constituent substances present in cane-juice there are also adsorption complexes which further complicate matters. These adsorption complexes consist of particles of colloids on the surfaces of which other colloids or crystalloids are adsorbed. Noel Deerr seems to be the only investigator who has subjected cane juice to a colloid-chemical analysis. He states that cane juice colloids are charged negatively, are irreversible as regards heat, but reversible in their behaviour towards alkalies. A sufficient number of facts have been accumulated to suggest the true nature of the mechanical effect of clarification, which may be briefly described as follows.

Heating causes colloidal particles to collect together into aggregates, but these are not sufficiently rigid to filter easily, since they tend to clog the pores of the filtering medium. When lime is added to the hot juice however, insoluble calcium salts are formed, and these separate out as rigid particles. The particles of calcium salts adsorb the colloids present in the juice, to a degree proportional to the area of surface exposed by them. Hence limed and heated cane juice filters more easily than does heated juice which has not also been limed. In the sulphitation process, a much larger quantity of finely divided rigid, solid particles is produced by the action of the sulphurous

acid on certain compounds present in cane-juice than when lime is used. Adsorption at the surfaces of these rigid particles is increased, and filtering becomes even more easy. In the carbonation process, the amount of precipitate is still larger, and herein we reach the possibility of almost perfect filtration.

If the above explanation is correct, it would appear that the introduction of some finely divided, chemically inactive substance into cane juice would effectively result in the adsorption of colloids, and consequently facilitate filtration. Since the majority of the colouring matters of cane juice are of a colloidal nature, such a process should bring about rapid clarification of the liquid.

A great number of adsorbents have from time to time been prepared for use in the sugar industry. Amongst these are bone black and other forms of carbon, silica, silicates, such as clay, gypsum, dolomite, saw dust, paper pulp, peat, bone meal, brick dust, and pumice stone. Of these certain of the various forms of carbon and of silica, have alone so far been found to be of practical value. Bone black is extensively used in the refining industry. Other forms of carbon however have been prepared which are much more effective in clarifying sugar solutions than bone black. The reason why these highly adsorbent forms of carbon have not been extensively used in the sugar factory for clarifying cane juice lies chiefly in the fact that they are expensive, and that they can be used only a very limited number of times. They therefore require frequent revivification. Being so highly adsorbent, the more efficient forms of carbon remove from raw cane juice, not only the colloid substances but also such substances as fine particles of fibre and of soil which have passed through the juice strainer. For this reason it is difficult and expensive to revivify the carbon for repeated use. Further, the use of carbons leads to a certain amount of inversion of sucrose which is in itself a drawback to their employment in clarifying cane juices. Hence in those factories where carbon is used to decolourise cane juice, it it customary partly to clarify the juice by chemical means as a preliminary, and then to complete the process by using a decolourising carbon.

It has been found however, that properly prepared Kieselghur can be employed as a substitute for the chemical agents used in the preliminary treatment of cane juice. Kieselghur has long been used as a filtering medium in sugar manufacture, but not until recently has any attempt been made to employ the material as a mechanical agent for clarifying cane juice without simultaneous chemical treatment.

Dr. Zerban has investigated in the laboratory the possibilities of using Kieselghur*, both alone and in conjunction with decolourising carbons for clarification, omitting chemical treatment altogether. The first question settled was that there is really little danger from inversion, when either Kieselghur or decolourising carbon is used in the proper way. Next it was found that a form of Kieselghur known as Filter-Cel is quite as efficient an agent in clarifying cane juice as sulphurous acid used in the sulphitation process. In another series of experiments it was found that a preliminary treatment of cane juice with Filter-Cel greatly facilitates the work of the decolourising carbon, Norit, because the Norit would have to remove impurities which are otherwise taken up by the Filter-Cel

While the laboratory results as summarized above seemed very encouraging from the standpoint of clarification, it was necessary to ascertain whether the process is feasible on a large scale, and how the final products, sugar and molasses, compare in quality and quantity with those obtained by other processes such as the sulphitation process. The method of procedure in the factory would presumably be first to treat the juice from the mill with Filter-Cel, then to filter in the filter press, at once to add Norit, and finally to filter again.

A procedure similar to the above was carried out under Dr. Zerban's direction in the factory attached to the Experiment Station at New Orleans. Three runs were completed. In each run, 8 to 10 tons of cane juice were used, and clarified in portions of about 3,000lb. each per clarifier. In the first two runs the raw juice was treated with ½ per cent. of Filter-Cel, heated to cracking point, then thoroughly mixed and sent through the press. Filtration was very rapid, and after a little pumping back, the juice came through perfectly clear but dark in colour. It was then mixed in a clarifier with 1 per cent. of Norit, reheated and refiltered. The juice now came out bright and almost water white. In the third run, the Filter-Cel was omitted and 1 per cent. of Norit used directly on the raw juice. The filtration was not so good as in the previous case. The juice ran slightly milkly for a while, but was nevertheless free from colouring matters.

The clarified juices from the three runs were next submitted to the usual evaporating processes in the boiler house In the first run, the syrup was directly boiled to grain. In the other two it was filtered through Norit, using 5 per cent. of this on the total solids in the syrup. It was found that Norit increased the purity of the products, and also decreased the ash and the organic non-sugars content. The removal of non-sugars would be expected to promote crystallization, and this was found actually to be the case.

It appears therefore that the findings of the first part of the investigation as carried out in the laboratory, are completely reduplicated in the trials performed under factory conditions. Further, it is to be noticed that the new process furnishes sugar and molasses of better colour and purity than do the processes in which chemical agents, such as lime, sulphurous acid, carbonic acid, or phosphoric acid are used. The yield also is in no way reduced by employing purely colloid-chemical methods of clarification.

Certain sugar planters of Louisiana have started factory experiments along lines similar to those of Dr Zerban's investigations, and have so far obtained data which seem to bear out his own conclusions. The results are so encouraging that every effort should be made to collect more data, especially data connected with costing. It seems highly possible that colloid-chemical methods of clarification in sugar manufacture may eventually replace the more purely chemical methods, especially when cheaper and more efficient adsorbents are discovered.

F.H.

* Kieselghur is a whitish pulverulent material which consists chiefly of the siliceous remains of diatoms laid down both in fresh and salt-water. Wide areas of it are now being deposited on the bed of the South Pacific Ocean. It is found fossil chiefly in Germany and the United States. In Barbados there occurs in the beds of the Oceanic Series a deposit known as infusorial earth, which is composed almost entirely of siliceous organisms including diatoms, radiolaria and sponge spicules, and which to some extent resembles Kieselghur in its general composition. Outcrops of infusorial earth occur at Springfield, Loamfield, Consets Bay, and Chimborazo in Barbados.

DOWN THE ISLANDS

ITEMS OF LOCAL INTEREST.

ST. LUCIA. Work in the Experiment Stations and Botanic Gardens during the month of September was of a routine character, Mr. E. Buckmire, the Acting Agricultural Superintendent, reports. H.R.H. the Prince of Wales paid a visit to the Botanic Garden on September 28, when he was graciously pleased to plant a palm (*Livistona chinensis*) at the main entrance to the Garden. Distribution of plants for the month was as follows: lime plants 200; grafted mangoes 3; other economic 6; ornamental, 49; together with 1 packet of vegetable seeds, and 58 ornamental plant cuttings. With regard to staple crops, Mr. Buckmire says that the weather for the month has been generally satisfactory for cultural operations on sugar-cane plantations. The plant canes look well, but are somewhat backward. The lime crop is in progress, and the Government Lime Juice Factory is kept busy. The following purchases were made at the factory: ripe fruit 405 barrels; juice 4,407 gallons. The quantity of juice dealt with during the month was 76,498 gallons. Shipment was made of 20 casks, equal to 815 gallons, of concentrated juice, and 5 cases, equal to 40 gallons of distilled lime oil. The picking of the cacao crop has begun on most estates, and the crop promises to be a satisfactory one. Where weather conditions favoured, many large patches have been planted with sweet potatoes and casava, but in the drier districts a smaller area has been planted in food crops than was planted at this time last year. Unfortunately the Indian corn crop has been mostly a failure all over the island. Clearing lands at Union for planting food crops and establishing varieties of sugar-canes have commenced. An interesting lecture on fertilizers was delivered to a large gathering of planters by Mr. C. T. Watts at the Agricultural and Commercial Society's rooms. The rainfall during the month was well distributed, 8·91 inches having been registered at the Botanic Garden, Castries, and 5·61 inches at Choiseul Station.

MONTSERRAT. The Curator, Mr. W. Robson, writes that during the month of September an ample rainfall was registered, and the prospects for crops in general have improved. Plants distributed during the month consisted of: lime plants 1,000, bay plants 1,200, together with 42 lb. of sword beans, 10 lb. of Lyon beans, and 18 lb. of fleshy pod beans, and also 96 packets of various other beans and peas. Attempts are again being made to cultivate experimentally a plot of *Datura Metel*, the local 'fire weed'. Seeds have been sown of hybrids between the Rangpur and the ordinery lime. Three distillations of bay leaves were made at the station. The rainfall during the month has been more than was exactly suitable for the cotton crop at its present stage, and some loss has taken place on account of soft rot of the bolls. Drier weather is hoped for to ensure a satisfactory second picking. The areas of poorer land which have been put under cotton are not likely to give large returns. In the Experiment Station the self-fertilization of flowers of the selected strains of cotton was completed. With regard to pests and diseases of cotton, Mr. Robson states that the leaf-blister mite is more generally observed than it has been for many years, which is also probably true of cotton mildew. Attacks of the cotton worm, however, have not been severe. The destruction of silk-cotton trees still existing in the island is proceeding slowly. It is to be regretted that comparatively little interest is being shown by the smaller cultivators in the Provision Gardens Competition, which was recently inaugurated. An Order-in-Council dated September 23, prohibits the importation of cotton seed or seed-cotton from all places outside the presidency. The rainfall for the month at Grove Station was 8·00 inches, making a total for the year of 35·38 inches.

BRITISH VIRGIN ISLANDS. With regard to the Experiment Station, Tortola, Mr. C. A. Gomez, the Curator, states that the Montserrat type of cotton continues to be the most promising of the varieties experimented with. Seed-beds for sowing onion seed, which it is hoped will soon be received, have been prepared. Distribution of plants was as follows: coco-nuts 390, other economic plants 450, Gliricidia cuttings 80, decorative plants 205. The cotton fields have shown improvement during the month, and the picking of the crop has begun. At Virgin Gorda the usual picking of the Sea Island cotton second crop began somewhat earlier this year than hitherto. Some growers have obtained very satisfactory returns. It is generally reported in Virgin Gorda that excellent results have been obtained this year from plants grown from seed obtained from Montserrat. In Virgin Gorda this type of cotton is doing extremely well, especially when the dry season through which it has passed is considered. In many places however, particularly in the East end of Tortola, the cotton crop will be a very small one, owing to the effect of the drought in July and August. Fortunately, pests of all kinds have given very little trouble. A bonus of 40 per cent. on the first payment for the 1918-19 cotton crop was distributed, to the great satisfaction of the peasant growers The rainfall for the month at the Experiment Station, Tortola, was 3·37 inches.

AGRICULTURE IN BARBADOS.

The weather for October, up to the middle of the month, has not been as favourable as was expected, and many planters are already bemoaning the conditions created by the pancity of the rainfall.

In the Christ Church area, the rainfall for the year is $22\frac{3}{4}$ inches, as against 28 inches for the same period last year, and in St. George, $24\frac{3}{4}$ inches as compared with $33\frac{1}{4}$ inches last year.

In the red soil distsicts the rainfall registered for October is $1\frac{3}{4}$ inches; for the year $38\frac{1}{2}$ inches; the rainfall in this area is only an inch less than last year's. A glance at the various rainfall registers in the island reveals the fact that since 1917 the rainfall has been gradually decreasing The rainfall up to the middle of October 1917 was 56 inches; in 1918, 50 inches; 1919, $39\frac{1}{2}$ inches; this year $38\frac{1}{2}$ inches.

In St. George, St. Philip, Christ Church and St. Michael, many fields of plant canes may be observed which have actually ceased growing at present, and have developed a considerable amount of yellow blades and dry hearts, which are being stripped and cut out. Many fields of ratoons have also failed.

In the south and centre of the island the canes are still green, but so far are hardly more than plants; scarcely any canes can be seen in the bunches. In the red soil area, north of a line from Clifton Hall to Sturges and Canefield, the plant and ratoon canes are in fairly good health and are promising. Some fields of plant canes and first ratoons have good lengths of cane already, and, if the weather for the remainder of the month is favourable, they will be very promising. In the lowlands of St. Joseph and St. Andrew the plant canes are good, but the ratoons are low. In St. Andrew some fields of plant canes are beginning to turn yellow. This is a very critical month for the development of canes, and is the time when young shoots are expected in each bunch, which add considerably to the tonnage and yield per acre. If there is not rain enough to help this, then all prospects will be seriously crippled.

Farmyard manure is being rapidly applied where fields are ready for it, and it may be noticed that a good deal of it is being put in the cane holes and covered with mould, in order that when it is removed before the plant is put in, the cane hole will have something to give the plant a start, There is still a scarcity of this valuable mauure, and many planters have given up all hope of obtaining sheep manure in time for their fields, and are resorting to artificial manure.

It has been recently observed that many more nests of ants are found in the land, particularly in cane fields, than before. These ants are to be seen in the cane bunches, and the loss attributed to them each year is considerable.

The young cotton crop in St. Lucy, it is said, is now being attacked by worms, as are also young potatoes. The potatoes recently planted are growing fairly well, but owing to the dry weather which prevailed during the last fortnight, hardly any supplying of them could be done. The yam crop has also been seriously checked in the black soils, and there will hardly be any early yams on the market this year. The breadfruit crop, which has been giving some assistance to the food supply for the past six weeks, is now really at an end. The Indian corn crop has been reaped at most places, and has not been a plentiful one. The resulting corn flour is being retailed at 8c. per pint.

Potatoes have also been scarce, and 6c. per ℔ is the current price now. It is hoped that with favourable weather the supply of ground provisions will be an adequate one, and that they will not only be planted merely to comply with the Vegetable Produce Act, but that the land in which they are planted has been well tilled and manured where it is possible to do so. (The Barbados *Agricultural Reporter*, October 16, 1920.)

ARTIFICIAL SILK INDUSTRY IN FRANCE.

The following extracts are made from an article which appeared in the *Journal of the Royal Society of Arts*, August 13, 1920, on the above subject.

The relative scarcity and high prices of silk and other textiles are at the bottom of a renewed interest that is being taken at present in the manufacture of the chemically-produced textile material known as artificial silk.

On account of the substance which it employs (wood), the new industry, developed by the Société de la Viscose has been enabled to adapt itself to any climate. Favoured by groups of Lyon merchants engaged in the French silk and textile industries, it has become widely spread throughout the civilized world.

The production of artificial silk, which in 1902 was 4,408,000 ℔, rose successfully to 11,020,000 ℔. in 1906, to 13,224,000 ℔. in 1912, and to 17,632,000 ℔ in 1914.

Progress in the artificial silk industry was checked during the war, while at the same time the demands for its products was greatly augmented on accounted of the paucity of all textiles. In spite of the fact that viscose silk is extremely inflammable and cannot resist humidity, uses for it were numerous during the war to replace other materials; and it was even found possible to make use of it directly in war work.

It is worth noting that the increasing activity of the artificial-textile industry, far from coming into competition with that of the natural silk, coincides with and supplements the growth of the latter. The production of natural silk increased from 41,876,000 ℔. in 1904 to 50,692.000 ℔ in 1906, to 59,508 000 ℔. in 1912, and only dropped to 48,488,000 ℔. in 1914 because of the war.

Viscose silk cannot be obtained in the really fine grades; its use is restricted for the most part, to such uses as do not subject it to fire and water. In short, taking into consideration that natural silks cannot supply the market, the artificial silk supplements the product, but does not compete with it except in the lower grades.

According to a report prepared at the United States Consulate at Lyons, a renewed impetus was recently given to the use of chemical textiles by the invention of an entirely new process, the product of which is called silk celluiose. This new form of cloth is claimed to possess a remarkable solidity and durability, a touch similar to silk, and absolute imperviousness to water; at the same time it is no more endangered by fire than the ordinary natural silks. While the threads of the viscose silks are, of necessity, relatively coarse and thick, the new silk permits of making threads of considerable fineness, and is particularly remarkable for the quality of the velvets which can be made from it. The new process differs radically from the old processes. Instead of converting a thick liquid (the viscose) into thread, it appears that it is possible to preserve the wood fibres and convert them into a brilliant and solid cellulose.

A large factory for the production of the new textile is being projected for large-scale commercial production in the Lyons districts where such materials as velvets, jerseys, satins, draperies, linings, and other silk goods will be woven. Although artificial silks can already be obtained at advantageous prices as compared with natural silks, the inventor of the new process claims that his product will be able to reduce still further the cost of chemically-produced threads.

Despite the fact that for years to come the artificial textile may not compete with natural silk, yet the producers of the latter must eventually look for advances and inventions on the part of chemist that may ultimately remove the defects now so obvious in the viscose silks. What is most needed is ability to spin a much finer thread, which is at present extremely difficult on account of the air which is held in the coagulating bath in which the artificial threads are formed. Seven or eight years hence, when there has been time for a surplus of artificial silk to accumulate on the market, by reason of the establishment of new plants and increased production of other textiles, those whose interest is bound up in the artificial silk industry will be forced to bring about a new development in order to enable it to hold its place; at that time real competition may be looked for between natural and artificial silks.

EDITORIAL NOTICES.

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Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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NOTES AND COMMENTS.

Contents of present issue.

The purpose and value of commercial and industrial exhibitions are discussed in the editorial.

Under Insect Notes, on page 346, will be found notes of interest on the corn leaf hopper, known in the West Indies as the corn fly, and on the Black weevil borea of bananas; and on page 347 a note on the control of cotton stainers,

On page 340 will be found a suggestive article as to the possibility of clarifying cane juice without chemical treatment.

On page 352 the article on implemental tillage in Trinidad, the first portion of which appeared in the two previous issues of this Journal, is concluded.

Index to 'The Agricultural News.'

The Index to Volume XVII of the *Agricultural News* has been most regrettably delayed in publication, owing to printing difficulties, and shortage of paper supply. It is, however, issued as a supplement with this Number, and may be bound in the usual manner with numbers 436 to 461 inclusive, which comprise the volume.

The index is useful for purposes of reference on matters relating to tropical agriculture in general; it is especially valuable as a guide to concise information supplied in the *Agricultural News* with regard to insect pests and plant diseases of cultivated tropical plants.

Subscribers to the *Agricultural News* are advised to bind their volumes, because only in this way can a periodical be reserved for future reference. Although much information of merely ephemeral interest is contained within the covers of volumes of this Journal, yet articles often appear of sufficient value to be kept as records on points of importance, and for future reference with regard to questions peculiarly affecting tropical agriculture in general, and more especially with regard to problems presented under West Indian conditions.

Sudan Grass.

Sudan grass is now grown in many places in the West Indies. Numerous bulletins have been published by the United States Department of Agriculture concerning it; *Bulletin 1126* is the most recent, and contains some very interesting information about its history, cultivation, and utilization. It was obtained in 1909 from the Sudan Government at Khartum as the result of a systematic search for a form of Johnson grass without the aggressive root-stock of this species. No other plant importation ever gained such immediate and widespread popularity in the United States. It is very closely related to the cultivated sorghums and hybridizes readily with them. The fact that it has no root-stock places it nearer the cultivated sorghums than Johnson grass, though for many years Johnson grass has been credited by some botanists with being the primitive form of the sorghums. Sudan grass, like the cultivated sorghums, never develops anything but fibrous roots, and therefore cannot become an obnoxious weed as the perennial Johnson grass does. It will grow and produce fair crops in regions of low rainfall, and in its ability to endure periods of drought is equal, though not superior, to the best varieties of sorghum. There is less danger of prussic acid poisoning in pasturing or feeding Sudan grass than is the case with the larger sorghums. Feeding experiments have shown Sudan grass to be an excellent roughage for working animals and stock cattle, and only slightly less valuable than alfalfa for milch cows.

The West Indian Tropical Agricultural College.

Information from the Right Honourable the Secretary-of-State for the Colonies has been received by the Imperial Commissioner of Agriculture for the West Indies to the effect that he considers that the promises and prospects of support received are sufficient to justify his proceeding with the necessary steps for the establishment of an Agricultural College in Trinidad. It is also stated that the College Committee has been reassembled. The Secretary-of-State has informed the Commissioner that he has communicated this information to the press.

Mosaic or Mottling Disease of Sugar-Cane.

In a communication to the local press, Mr. J. R. Bovell, I.S.O., Director of Agriculture, Barbados states, that he considers that the Mosaic disease has appeared among the sugar-canes in that island. He has examined several diseased canes, and has no doubt that they are attacked by that troublesome disease. He rightly advises planters therefore to be on the lookout, and to take the greatest precaution against using any portion of the diseased canes for planting purposes.

In this connexion it may be noticed that fears were lately entertained in St. Lucia that the disease had made its appearance there also. Specimens of the suspected cane were forwarded to Trinidad for investigation by Messrs. W. Nowell and C. B. Williams, who reported that they were of opinion that the disease in that case, though having a superficial resemblance to the Mosaic disease, was in reality due to some other cause. The position, however, in St. Lucia is being kept under careful observation.

Queen of Flowers.

One of the most conspicuous large flowering trees to be seen in Botanic Gardens, and as an ornamental tree grown in private grounds, is what is known commonly in the West Indies as the 'Queen of Flowers' (*Lagerstroemia Flos Reginae*). In the flowering season it bears masses of purplish-pink flowers which, against the bright green foliage, produce a striking effect. This tree seems to flourish in the wetter islands, such as Dominica and Trinidad. It is not however indigenous to the West Indies, but has been imported from India, where it grows as a forest tree, more particularly in Assam and Burma.

In India the tree is highly valued as a timber tree, the wood being especially employed for boat building, as it is said to resist the action of salt-water better than any other timber, and also to resist the attacks of marine borers.

The question as to the kinds of trees most suitable for reafforestation in the West Indian islands is one that is engaging some attention, especially in Trinidad. Donbtless, valuable kinds of indigenous trees are probably most suitable for this purpose; still, on the other hand, it might be well to consider whether such a tree as the 'Queen of Flowers,' which grows readily from seed, and attains large dimensions in a short time, and also yields a valuable timber, might not be employed with advantage for afforestation in certain situations.

There is another species of Lagerstroemia, *L. indica*, which is very common throughout the West Indies as a garden shrub. This never attains to the dimensions of a tree, but is only a large shrub, with pink or white panicles of delicate flowers. It is known in some of these islands as the 'King of flowers,' and the American florists have bestowed upon it the name of 'Crape jasmine.' This must not be confused with *L. Flos Reginae*, it being of no economic value.

Packing Avocado Seeds for Transport.

In connexion with enquiries recently made with regard to sending avocado seeds to the Department of Agriculture, New South Wales, the following information from a note contributed to the *Bulletin of the Department of Agriculture, Trinidad and Tobago*, Vol. XVII, page 56, by Mr. R. O. Williams, the present Superintendent of Agriculture, Grenada, is of interest.

The seeds of the avocado germinate very quickly, in fact in some cases when the ripe fruit is open, germination has already begun. There is therefore considerable difficulty in transporting them to distant places in such a condition that they retain their vitality.

An experiment was carried out at the St. Clair Experiment Station, Trinidad, to find whether it was best to use fruits or seeds alone for shipment to long distances, and also as to what was the best packing material. For this purpose 200 avocados were divided into four lots of fifty; two fifties being fruits, and two fifties seeds. One lot of fruit and one lot of seeds were packed in charcoal, and the other lot of fruit and the other lot of seeds were packed in coco-nut fibre. Eleven weeks after packing the boxes were opened, with the result that of the whole fruits, forty-five in charcoal were dead, as were also forty-six of those in coco-nut fibre. On the other hand, only two of the seeds in charcoal were dead, and none of those packed in the coco-nut fibre, Examination showed, however, that the seeds packed in coco-nut fibre had made a great deal of root, and the plumule was very much elongated, whereas those packed in charcoal had made much less growth, proving that charcoal was the better material to use. The employment of the whole fruit, as was shown from the results obtained, is a decided mistake.

INSECT NOTES.

THE CORN LEAF-HOPPER.

The corn leaf-hopper (*Peregrinus* [Delphax] *maidis*) is known to planters and others in the West Indies on maize plants, but it seldom occurs in sufficiently large numbers to cause it to be regarded as a serious pest. The most common name for this insect in the West Indies is the corn fly.

Bulletin No. 7, issued by the Board of Commissioners of Agriculture and Forestry of the Territory of Hawaii, Division of Entomology, entitled 'The Corn Leaf Hopper (*Peregrinus maidis*, Ashmead)' gives an account of this insect in Hawaii, from which the following notes are largely taken. In the introduction it is stated that peculiar conditions brought about by the European war stimulated the production of Indian Corn to an unprecedented degree. In 1918 probably 10,000 acres were planted to this crop in the islands.

The corn leaf-hopper in Hawaii attaches itself only to corn, but it is recorded as attacking other gramineous plants in other places.

The insect feeds by puncturing the epidermis of the leaf with its sharp beak and sucking the cell sap. When the hoppers occur on corn plants in large numbers, the effect is similar to that of a serious drought, as a result of the loss of a large amount of plant juices. The punctures made by the insects in feeding, and by the females in the deposition of the eggs, gives access to the spores of fungi, and to other organisms, causing disease and abnormal growth.

The food of the corn hoppers contains very little solid matter. In consequence a very large amount is consumed, and great quantities of sweetish substances are given off by these insects, and, when the hoppers are abundant, the leaves and stalks of the corn are covered with this material, which encourages the growth of sooty mould or black blight.

The corn leaf-hopper is one of the Hemiptera-Homoptera of the Family Delphacidae. It is closely related to the leaf-hopper of the sugar-cane in the West Indies (cane fly), and, though smaller in size and differently marked, has similar habits.

LIFE CYCLE.

These insects pass through an 'incomplete' metamorphosis, that is, in their development from eggs to adult the immature stages are similar in general form to the adult, and there is no quiescent pupa stage.

The egg of the corn leaf-hopper is 0·8 m. in length, curved cylindrical, and somewhat pyriform in shape, and pearly white in colour. They are deposited mainly in the midrib of the leaf on the upper face and sometimes in the stalk. The female insect, by means of the strong, saw-tooth ovipositor, hollows out cavities in the soft tissues and inserts the egg, one to four in a cavity, with the 'head' end of the egg outermost. The eggs are often laid in regular rows, sometimes in double rows, a slight distance apart.

LENGTH OF LIFE CYCLE.

The eggs hatch in warm weather, in about nine days, the nymph or immature stage occupies fifteen to twenty five days when the insect becomes adult with the sexual organs developed and functional, and the wings also developed. There are two forms of adults as to wing development: those with ordinarily full-sized wings, and those with short wings. The long-winged form is generally more numerous than the short winged, in the proportion of about 1-2 in both sexes. The females are much more numerous than the males.

CONTROL.

Artificial means of control for the corn leaf-hopper had been tried but not extensively, and it seems to be doubtful if much is to be hoped for along this line.

In Hawaii the natural enemies of the corn leaf-hopper have given the most effective control so far secured. Chief among these are egg-parasites—two Mymarid parasites, *Paranagrus osborni* and *Anagrus frequens*; two Tetrastichine parasites, *Ootetrastichus beatus* and another species known as the Formosan Ootetrastichus. The former of these, the Mymarids, are believed to be by far the most effective of the parasites of the corn hopper.

In addition to the egg-parasites, there are the Dryinid parasites of which *Haplogonatopus vitiensis* is an example. The egg of this parasite is inserted in the body of the corn hopper when it develops. This type of parasite is less useful than the egg-parasites, since it does not prevent the pest from doing a certain amount of feeding while the parasite is developing. Haplogonatopus is of rather rare occurrence, and is in its turn heavily parasitized.

Predaceous enemies of the corn hopper are quite common. Among these are lady-bird beetles, ants, the predaceous bug (*Zelus peregrinus*), earwigs, and spiders.

In the West Indies two Mymarid egg-parasites are recorded, *Anagrus flaveolus* in Trinidad, and *Anagrus flavescens* in Barbados. The native lady-birds, the predaceous bug, *Zelus rubidus*, as well as ants and spiders also probably feed on these insects when they are abundant

H.A.B.

THE BLACK WEEVIL BORER OF BANANAS.

The weevil borer of bananas has several times been referred to in the columns of the *Agricultural News* within the past few years This insect (*Cosmopolites sordidus*), has long been known as a pest of bananas, and has been recorded as occurring in the West Indies for some time, but, until it was recognized as doing damage in Jamaica on a scale of some importance in 1916, it had attracted little attention in this part of the world. In that year Mr. A H. Ritchie, B.A., recorded the banana weevil in that island as a pest of some importance. (*Agricultural News*, Vol. XV. 1916, p. 123.) In 1900, plantains were rather seriously attacked in Dominica by this insect, and more recently it was reported from Martinique and Trinidad.

This insect is generally distributed throughout tropical regions where the plantain and banana are found.

In Fiji it has been of very considerable importance as a pest, and an account of its occurrence in that group of Islands was given in a recent number of the *Agricultural News* (Vol. XIX, p. 202, June 25, 1920), in an article reproduced from the *Colonial Journal* for April 1920.

In the *Agricultural Gazette* of New South Wales, November 3, 1919, p. 815, an account of the insect was given in an article on the Black Banana Stem Weevil, and in the *Journal of Agricultural Research*, Washington, D.C., Vol. XIX, No. 1, April 1920, there appeared an article on this insect, under the heading Banana Root borer, which has special reference to its occurrence in Florida. In Australia this insect has not assumed the serious nature of a pest. In Florida where the cultivation of the banana is being taken up on a fairly large scale, it is considered a pest with great potentialities for harm. From all information at present available, it would appear that the banana weevil is distributed from place to place, and even from field to field along with banana bulbs or suckers as for planting, in which or on which the insect in one or other of its stages might be transported. In the matter of control, a very interesting line of work has been undertaken in Fiji, where since 1911 importations of a predaceous beetle, *Plaesius javanus*, have been made from Java. Difficulty was experienced at first in packing the beetles, so that they arrived in a living condition. Later importations in which they were packed in sphagnum moss were more successful, a large portion of the beetles arriving alive, and it is believed that *Plaesius javanus* is now thoroughly established in Fiji, where it is hoped that it will prove of great value in keeping the banana weevil in check.

Trapping the beetle by means of pieces or slices of banana bulbs has been found of value. The portions of the banana bulb are distributed on the ground in infested plantations, and the beetles are attached to them in considerable numbers. It is necessary that frequent collections of the beetles should be made from these trap pieces, and at intervals of not more than twenty-one days the pieces should be collected and burnt in order to destroy the grubs which may be developing in them. If this is not done, the traps will become additional breeding places for the pest.

H.A.B.

THE HAWAIIAN SUGAR-CANE BORER IN COSTA RICA.

A CORRECTION.

In the *Agricultural News*, August 9, 1919 (Vol. XVIII, No. 451), the Insect Notes on page 250 consisted of notes on some insect pests in Costa Rica. These were abstracted from a paper by Mr James Zetek, Entomologist, Ancon, Canal Zone, and dealt with three insects which had been observed during a visit to Costa Rica.

In thee notes Mr. Zetek recorded the sugar cane weevil (*Rhabdocnemis obscura*, Bois.) as being found abundantly in banana stumps and cuttings at Zent, Costa Rica.

More recently a note by Mr. Zetek has appeared in the *Journal of Economic Entomology* (Vol. 13, June 1920, page 323), in which a correction is made to the former record. Identification of the specimens collected indicates that the insect referred to as attacking bananas in Costa Rica was the black banana weevil (*Cosmopolites sordidus*, Germ.) and not the Hawaiian sugar-cane weevil (*Rhabdocnemis obscura*).

The black weevil borer of bananas (*C. sordidus*) and the West Indian sugar-cane weevil borer (*Metamasius sericeus*) were stated to be abundant in Panama and the Canal Zone.

CONTROL OF COTTON STAINERS IN ST. VINCENT.

The following note, by Mr. T. Jackson, Agricultural Superintendent, St. Vincent, is of importance and interest to cotton growers generally:—

In view of the fact that there were rumours of cotton stainer attacks in various parts of the island, agricultural officers visited during the month numerous estates in various parts of the colony. Some forty estates and numerous small holdings were visited.

On fourteen estates no stainers were found, on twelve they were present in small numbers, on nine they were found in fairly large numbers, and on the remainder they were numerous. None were found at Bequia. On small holdings much the same conditions obtained as on larger estates.

On nearly all estates and small holdings the pest is being trapped and destroyed. The general opinion is that there are probably more stainers in the island now than there were at this time last year, but that the attack was not any earlier than last season. It will doubtless be remembered that Sir Francis Watts was recently in St. Vincent, and one effect of his visit has been to direct planters' attention to the danger of stainers. Possibly, if he had not come, many cases of stainer attacks, which are now reported by planters, would have remained unnoticed.

There are now in St. Vincent, in the strict sense of the word, no food-plants for stainers to breed on during certain months of the year, and some reason must be sought for the present condition. This season, speaking generally, planters and peasants have given more attention to manuring than they have done in previous seasons. A very large proportion of the manure has been applied in the shape of cotton-seed meal. In certain cases this was not covered sufficiently deep to prevent stainers feeding on it, and it is possible that numbers were able to breed for a limited time on this material. Again, a large quantity of cotton was spoilt in the fields last season on account of heavy rains. In the shape of unopened bolls and immature cotton this provided a source of food on which large numbers of cotton stainers could breed. In addition, it must be remembered that there was in St. Vincent a record area under cotton last year; and it follows that the greater the food supply, the greater the number of insects present. The insects appearing this season are the survivors of those from last crop, and consequently the more which breed in one year (allowing the percentage dying or destroyed by natural agencies to be constant), mean the more survivors there are for the succeeding year.

The present position may be summed up as follows:—

1. There have probably been more stainers present in the island now than there were this time last year.

2. The causes of this are: —

(a) Indifferent burying of cotton-seed manure.

(b) The large amount of debris cotton left in some fields.

(c) The increased area under the crop last season.

3. Planters are alive to the position, and are doing their best to keep the pest under control.

It would seem as though efforts to control stainers should be directed to destroying as many as possible at the end of every crop, before they leave the field. When plants are being destroyed, traps should be laid. It would seem as though this method would be effective, for it is improbable that insects would leave an abundant food supply and stray into scrub. Of course, if careful supervision is not carried out, more harm than good may be done.

The effective covering of cotton seed manure requires attention.

GLEANINGS.

According to the report of the United States Custom House at Honolulu, the shipments of sugar during the fiscal year ended June 30. 1920, were to the value of $118,961,556, and it is indicated that 1920 will go well above the $150,000,000 mark. Sugar accounted for more than 80 per cent. of the total value of exports from the island during the year. (*Facts About Sugar*, October 2, 1920.)

The output of sugar in the Hawaiian Islands for 1918-19, according to the *Louisiana Planter*, September 18, 1920, was 538,913 long tons. This shows the great progress in the sugar industry of those islands. In 1854 the sugar crop amounted only to 262 tons, and although it rose to 7,995 tons in 1875, it was authoritatively considered that it would never exceed 75,000 to 85,000 tons annually.

The *Agricultural Gazette* of Canada, September 1920, states that from the enperiments of dairy farmers it would appear that cows producing a large quantity of milk can be induced to give more milk in three milkings than if milked twice only in the twenty-four hours, because when the udder is much distended, it is advantageous to relieve it more frequently than twice per diem.

Before the war the value of the annual exports of cow hides from India was about £4,000,000, while goat skins to the value of over £2,000,000 were annually exported, and in addition, over £1,000,000 worth of tanned goat skins. The annual values of the buffalo hides and sheep skins exported from India before the war were about £1,500,000 and £900,000 respectively. (*Journal of the Royal Society of Arts*, September 10, 1920.)

It is estimated that in 1880 the United States consumed 110,000,000lb of confectionery, and this had risen in 1919 to 1,400,000,000lb, or thirteen times as much as in 1880. The value of the candy in 1880 was estimated at $33,700,000, and in 1919 it was $1,200,000,000. The average per capita consumption in 1880 was 2·2lb, while that of 1919 was over 13lb. The per capita cost of the candy was $1·70 in 1914, and $11·39 in 1919. (The *Louisiana Planter*, October 2, 1920.)

In the Report on the Agricultural Department, Assam, for the year ended March 31, 1920, it is stated that in the Assam valley, the imported sugar-cane varieties—Striped Mauritius, B.147, and B.376—have everywhere proved their superiority over the local kinds, and are highly appreciated by the cultivators. The supply of plants is not adequate at present to meet the demand for them. Greatly increased attention is being paid to sugar-cane, which has become a very profitable crop owing to the present high prices of gur and sugar.

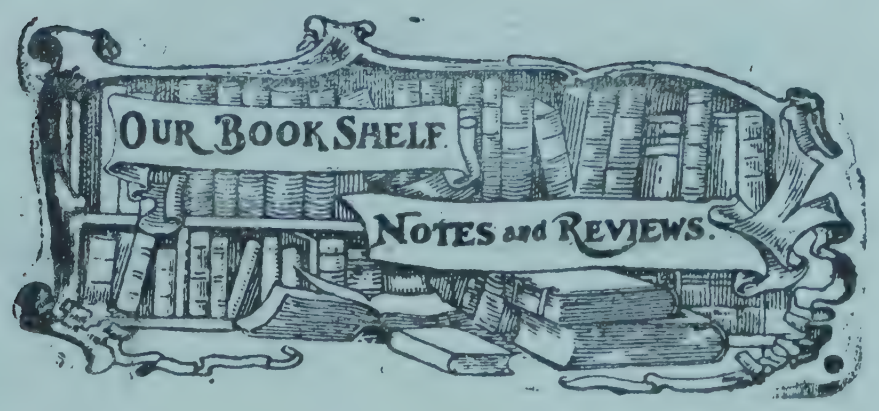
A note in the *West India Committee Circular*, September 30, 1920, calls attention to the increasing demand for copra and coco-nut oil to an extent far exceeding the pre-war scale of production. It is remarked that about 24,000 acres are now planted with coco-nut palms in British Guiana, 35,000 in Jamaica, 27,000 in Trinidad and 9,000 in Tobago. It is stated that local varieties of the palm will yield heavy crops of medium sized nuts on relatively heavy clay soils on the coast land of British Guiana, while on lighter lands similar varieties produce much larger nuts.

The extraordinary vitality of prickly pear seedlings is noticed in the *Agricultural Gazette* of New South Wales, August 2, 1920. It is stated that some seedlings were left for long over twelve months without a drop of moisture being supplied to them. The first healthy green shoots, as they failed, put forth at the tip smaller second shoots, and then from the end of these seconds a third set of tiny shoots, thickly protected with spines, appeared, and finally withered off. More than eighteen months elapsed from the time of germination before all the seedlings were pronounced to be dead.

The value of the long-staple cotton crop in Southern California and Arizona last year was over $20,000,000. For this year the returns are estimated at fully $100,000,000. The industry is but eight years old, and so far has not had to contend with the boll weevil, which for years has ravaged the cotton plantations along the Atlantic sea-board and the Gulf of Mexico. The development of this industry is largely due to the foresight and enterprise of a number of big manufacturers, who financed planters, erected gins, and themselves planted thousands of acres. (The *India Rubber World*, October 1, 1920).

In the *South African Sugar Journal*, August 1920, it is stated than an Australian has invented a machine for planting canes, which may be of value to the industry in all parts of the world. Briefly stated, the object sought and attained, it is claimed, by this machine, is the opening of the drills for cane plants on ploughed land, the depositing of the plant at the required depth in the drill, and the covering over of the plant with the necessary amount of earth, in one operation, with the labour of four horses and one man. It will be interesting to note whether this invention will be practically useful.

In the Medical Report on the sanitary condition of the Presidency of St. Kitts-Nevis for the year 1919, it is stated that, realizing the mistake of entire dependence on outside sources for the main food supply, the inhabitants of Anguilla placed a larger area of land under cultivation in foodstuffs than ever before, thus securiug an adequate amount of maize, Guinea corn, peas, beans, yams, and sweet potatoes. A fair quantity of fish was caught, and what was not eaten fresh was salted and dried. The cows in the island were carefully kept, in order to supply milk for the children, and also for cooking with peas to compensate for the scarcity of fats. Consequently the entire population was well nourished during the year.



A HANDBOOK OF ST. KITTS-NEVIS, AND PRESIDENCY OF THE LEEWARD ISLAND COLONY. Containing Information for Residents and Visitors concerning the Islands of St. Christopher or St. Kitts-Nevis, and Anguilla. By Katherine Janet Burdon London. *The West India Committee.* Price 5*s*. Post Free 5*s* 6*d* —

From time to time handbooks on various West Indian islands have been issued which are of value and interest, not only to visitors to the West Indies, but also to residents in these islands. One of the most interesting and accurate of these is the one under review, which has been published recently by the authority of the Government of St. Kitts-Nevis.

In her preface the author, Mrs. Burdon, the wife of Major Burdon, C.M.G, the present Administrator of the Presidency, disarms criticism by frankly stating the difficulty of the task she undertook. One can only say that she has admirably surmounted the difficulties and accomplished the task.

The handbook is divided into four parts, the first of which deals with the Presidency as a whole, its previous history and its constitution. This part also contains information with regard to puplic departments, and statisitcal information on various points. For the general reader this portion is not of so much interest as the rest of the book, but is of considerable service toresidents in the presidency and to persons having business therewith.

The other three parts deal with the three islands of the Presidency, St. Kitts, Nevi sand Anguilla, in the order named. Naturally St. Kitts, as the principal island, occupies the largest space in the book, and information of the most varied character with regard to its past history, its scenery and climate, and its agriculture, together with notes on the geology and the flora and fauna of the island will be found presented in an admirable fashion. For the information of tourists the last two chapters of this part will be found valuable, containing as they do hints as to accommodation and transportation, together with suggestions as to excursions to various points of beauty or of historic interest in the island.

The part devoted to the island of Nevis is shorter, but the information contained is on the same lines as that about St. Kitts.

Part IV, which deals with Anguilla, gives similar information about that island.

It would be a great pleasure to give quotations from this handbook, did space allow. We can however only advise all interested in these islands to read it for themselves; and we congratulate Mrs. Burdon on her little book.

Besides containing many illustrations reproduced from original photographs, which are admirably executed, the handbook also contains excellent reproductions of the maps recently published by the author's husband, Major Burdon, which were noticed in a recent issue of this Journal.

In conclusion it only remains to add a word of praise to the 'format' of the volume. It is tastefully bound, and a statement is made that the solution used in binding has been specially prepared in order to render the work impervious to the ravages of insects. The volume is handy in size, and is clearly printed in bold type.

EXAMINATIONS IN PRACTICAL AGRICULTURE.

The following are questions from the papers set for the Intermedate Examination, 1919, to which attention was directed in the previous issue of this Journal.

GENERAL AGRICULTURAL SCIENCE.

A.

Name and describe any weevil you have examined, and give an account of its life history and feeding habits.

2. What are the characteristics of a fungus?

3. Describe the effects of *Marasmius Sacchari* (root disease fungus) on sugar-cane in your island.

4. State what you know concerning the resistance of crops to attacks of pests and diseases

B.

5 What manures are commonly supplied to sugar-cane in your island, and in what quantities? Give an account of their compositions, relatively

6. Describe the nature of the soil in your island.

7. Give an account of any system of irrigation or conservation of water-supply that you are familiar with.

C.

8. Describe two diseases or maladies affecting oxen. How might they be prevented?

9. Describe the appearance and habit of growth and yield of two fodder grasses.

10. Explain the chief differences between protein and carbohydrates. Give examples of substances rich in each, respectively.

SPECIAL CROPS.

A. SUGAR-CANE.

1. Give an account of the results obtained so far in regard to your island seedling canes (locally bred).

2. What is the present cost of labour in your island? Give a few figures showing the average cost of planting, weeding, and cutting cane.

3 Describe the implements used in your island in the cultivation of sugar-cane. Have there been any changes of recent years?

4. How would you select and deal with planting material for establishing a field of sugar cane?

5. Compare plant and ratoon canes in regard to which pays better in your island.

6. Describe in outline an ordinary day's work

B. COTTON.

1. Make an examination, and record the results in tabular form, of the specimen or cotton submitted to you.

2, How is land prepared for growing cotton, and at what time of the year?

3. What area of land would you expect to get planted with seed in a day? How many people planting?

4. At what depth and at what distance are the seeds planted?

5. Make a practical statement as to how the cotton worm is dealt with.

6. How is cotton in your island dried and prepared for ginning?

IMPLEMENTAL TILLAGE IN TRINIDAD.

(*Concluded.*)

Ploughing or Breaking Land and Preparing Land for Planting Canes.

PLOUGHING OR BREAKING LAND.—The first ploughing after the crops were reaped, of 23 57 acres planted partly in canes and partly in cotton was done during March, April, May and June as was found convenient.

This ploughing was done partly with Nos 9 and 12 ploughs in 55¼ days of nine hours by one man and three boys with four oxen working on an average 0·42 acres per day. The cost per acre works out at $2 92 for labour and a total of $5·50, including depreciation of implements and feed of animals

PREPARING LAND FOR PLANTING CANES.—Field 4, St. Augustine consisting of 12·56 acres was ploughed in April-May after a cotton crop In August-September 10·76 acres were reploughed, of which 2·56 acres were prepared by hand labour and the balance of the field, 10 acres, with implements for planting canes. The first and second ploughing cost $5·50 and $4·80 respectively, per acre.

PREPARED WITH IMPLEMENTS—10 ACRES

FIELD 4, ST. AUGUSTINE.

Description of work.	Number of Labourers	Number of Animals.	Cost of labour.
			$ c.
Harrowing with locally made harrow The work was performed in 8¾ days by one man and two boys with 4 oxen (on two days only two oxen worked)	26·50	32·30	8·70
Drilling with pony plough. The work was done in 24½ days by one man and a boy with one mule ...	49·10	24·50	19·20
Banking with double mould board plough. The work was performed in 4½ days by a man and a boy with one mule*	9 20	4·60	3·80
Subsoiling bottom of drills with horse-hoe. The work was performed in 4 days by a man and a boy with one mule	8·00	4 00	3·20
Total for 10 acres	92·80	65·40	34·90
Per acre	9·28	6·54	3·49
Depreciation of implements ...	...	...	·15
Extra feed of oxen	...	...	·85
Extra feed of mules	...	...	·92
Total per acre ...	9·28	6·54	5·41

* Banking with the double mould-board plough was necessary only on account of the desire to plant potatoes on the banks.

If oxen had been used for drilling with No 9 or 12 plough it would have cost and taken the following number of labourers and animals.

Description of work.	Number of Labourers.	Number of Animals.	Cost of labour.
			$ c.
Harrowing with local made harrow. The work was performed in 8¾ days by one man and 2 boys with 4 oxen (on two days only 2 oxen worked)	26·50	32·30	8·70
Drilling with No. 9 or 12 plough. The work was performed in 21⅔ days by a man and 3 boys with 4 and occasionally 6 oxen ...	86·70	107·80	30·60
Banking with double mould board plough. The work was performed in 4½ days by a man and a boy with one mule	9·20	4·60	3·80
Subsoiling bottom of drills with horse-hoe. The work was performed in 4 days by a man and a boy with one mule	8·00	4·00	3·20
Total for 10 acres ...	130·40	148·70	46·30
Per acre	13·04	14·87	4·63
Derpeciation of implements ...	...	...	·15
Extra feed of oxen	...	...	3·71
Extra feed of mules	...	...	·24
Total per acre ...	13·04	14·87	8·73

The cost and number of labourers required per acre to prepare the above 10 acres by hand labour alone is given below.

Description of work.	Labourers.	Cost.
		$ c.
Banking lengthways 3 banks to a bed=6,000 feet of banks at 15 cents per 100 feet	15 00	9·00
Forking bottom of drills, 4 to a bed=8,000 feet of drills at 4 cents per 140 feet	3·80	2·28
Total per acre ...	18·80	11·28

From the above tables it will be seen that when drilling is done with mules it takes 3·76 labourers and costs $3·32 less than with oxen. Similarly for the whole work it takes 9·52 and 5·76 labourers and $5·87 and $2·55 less per acre when the drilling is done with mules and oxen, respectively, than by hand labour alone. This is based on the assumption that the hand labourers work a task and a half, or for 60 cents a day.

General Conclusions.

The figures in all of the foregoing tables in respect of implemental tillage are the results of what has actually been done and have not been calculated on what the best animals can do. No allowance has been made for time lost when animals were being broken in or when they worked badly. It is probable therefore, that with well-trained animals more work can be done, and at a cheaper cost. When it is stated that a certain work was performed in, say, five days, it is not meant to infer that it was done in five consecutive days, but that the time occupied in performing the work amounted to five days work of nine hours.

The advantages of implemental tillage are (1): the cost is lower, (2) fewer labourers are required to work an acre especially when cultivating with mules, (3) the kind of labour required is more easily obtained than that for working with hand labour alone, and (4) with sufficient stock and implements a larger acreage can be worked in a given time.

In cultivating growing canes the land is not so thoroughly tilled by implements as by hand labour; on the other hand, a better preparation for planting is obtained by the use of implements. Another important factor in favour of implemental tillage is that approximately two-thirds of the labourers required are young boys who might otherwise be idle. Incidentally they get a good training in the use of implements, and the handling of animals for later years.

It remains to be seen however, whether better crops will be obtained from implemental tillage supplemented by hand labour as compared with manual labour alone. Experiments have been planned on ratoon canes in Field 2, but unfortunately on small plots, as all the fields are planted with several varieties of cane, and no large area planted with a single variety was available. Another experiment has also been started in Field 4 to test the relative merits of preparing and tilling the land with implements supplemented by hand labour as against manual labour alone.

The actual account of work performed, the number of labourers and animals used with each implement, the average acreage worked per day, together with the cost of labour, depreciation of implements, extra feed of animals, and total cost per acre is given in the following table :—

Description of work performed and implements used	Acreage worked.		Per acre.			
	Total	Average per day.	Cost of labour.	Depreciation of implements.	Extra feed of oxen	Total cost.
	Acres.	Acres.	$ c.	$ c.	$ c.	$ c.
Cultivating middles with 'one mule' plough.						
(*a.*) One man and a boy with a mule ...	25·85	2·25	0·33	0·03	0 12	0·48
(*b.*) One man and 2 boys with 2 oxen, each ox working half-day	9·25	0·80	0·97	0·03	0·66	1·66
(*c*) One man and 2 boys with 2 yokes of oxen, each yoke working half-day ...	5·50	1·69	0·54	0·03	0·63	1·20
(*d.*) One man and 3 boys with 2 yokes of oxen working all day ...	4·00	1·60	0·81	0·03	0·66	1·50
Pulverising with No. 82 'E' horse-hoe.						
(*a.*) One man and a boy with a mule ...	59·15	2·25	0·29	0·03	0 12	0 44
(*b.*) One man and 2 boys with 2 oxen, each ox working half-day ...	1·75	1·17	0·73	0 03	0 45	1·21
Banking with Celery Hiller.						
(*a.*) Moulding growing canes—one man and a boy with a mule...	16·22	3 24	0·24	0 06	0 09	0·39
(*b.*) Banking to plant canes—one man and a boy with a mule..	8·70	2·17	0 38	0·06	0·13	0·57
Subsoiling drills with No. 82 'E' horse-hoe.						
(*a.*) Cultivating growing canes—one man and a boy with a mule...	14·27	3·11	0·23	0·03	0 09	0 35
(*b.*) Preparing land for planting canes—one man and a boy with a mule	8 70	2·48	0 32	0·03	0·11	0·49
Ploughing with Nos 9 and 12 ploughs.						
(*a.*) Dry season—One man and 3 boys with 4 oxen ...	27 33	0·42	2·92	0·06	2 52	5·50
(*b.*) Rainy season—one man and 3 boys with 4 and occasionally 6 oxen ...	10·76	0·57	2·36	0·06	2 38	4·80
Harrowing land and levelling with 'spring teeth' harrow.						
A man and a boy with 2 oxen ...	2·73	0·42	2·00	0 03	1 26	3·29
*Harrowing with 'spring teeth' harrow.**						
A man and 3 boys with 4 oxen	1 33	0·84	1·47	0 03	1·26	2·76
*Harrowing with 'locally made' harrow.**						
A man and 2 boys with 4 and occasionally 2 oxen	8·20	1·13	0·87	0 03	0·85	1·75
Drilling to plant canes						
(*a.*) With Nos. 9 and 12 ploughs—one man and 3 boys with 4 and occasionally 6 oxen	4·50	0·46	3·06	0·06	2·86	5·98
(*b.*) With pony plough—one man, a boy and one mule ...	5·50	0·41	1·92	0·03	0·69	2·64

* This implement is easily worked with two oxen, but as the extra animals were on the spot when doing this work, they were utilized.

MARKET REPORTS.

London.—The West India Committee Circular. September 30.

Balata—Venezuelan Block, no quotations; West Indian Sheet, 4*s.* 7*d.* to. 4*s*7½*d.* c.i.f., spot and forward, 4*s.* to 4*s.* 3½*d.*
Beeswax—No quotations.
Cacao—Trinidad, 78*s.* to 38*s.* Grenada, 78*s.* to 80*s.*; St. Lucia, Dominica and Jamaica, no quotations
Copra—£58. c.i.f, London, and £58 10*s.* c.i.f. Holland
Honey—62*s.* 6*d.* to 90*s.*
Lime Juice—Raw, no quotatons. Concentrated, no quotations.
Pimento—4*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs T. S. Garraway & Co., October 25.

Arrowroot—$8·00 per 100 lb. duty paid.
Cacao—Lottings at $18·00
Coco-nuts—$70·00 for large, $36·00 for small husked nuts.
Hay—Sales at $6·00.
Onions—Lottings at $10·00.
Peas, Split—No quotations; Canada, $12·00 small, $12·50 large green.
Potatoes—New crop, sales at $13·50 per 160 lb.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, September 21.

Bay Oil—30*s.* per lb. spot, and 28*s* forward.
Lime Oil—6*s.* for West Indian distilled, and for hand-pressed 26*s.* per lb.
Orange Oil—West Indian, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., October 6.

Cacao—Venezuelan, $18·50.
Trinidad, $17·25 to $17·75.
Coco-nut Oil—$1·95 per gallon.
Coffee—Venezuelan, 16c. to 17c. per lb.
Copra—9c. per lb.
Dhal—No quotations.
Onions—$8·75c. per 100 lb.
Peas, Split—$8·75 per 100 lb.
Potatoes—English, 8 to 10c. per lb
Rice—Yellow, $14·50. White, no quotations.
Sugar—No quotations.

New York.—Messrs. Huth, Gillespie & Co., Inc October 7.

Cacao—Caracas, 14c. to 14½c.; Grenada, 13½c. to 14c; Trinidad, 14c. to 14½c.; Jamaica, 10c. to 11c.
Coco-nuts—Jamaica selects, $52·00 per M; Trinidad $48·00 per M; Jamaica, $35·00; Trinidad $30·00 per M. culs.
Copra—7½c. to 7¾c.
Coffee—Jamaica, 10c. to 13c. per lb.
Ginger—30c. to 34c. per lb.
Goat Skins—Jamaica 65c, Antigua, Barbados, St. Thomas and St. Kitts 55c.
Grape Fruit—Jamaica, $3·50 per box.
Limes—$6·00 to $8·00 per brl.
Mace—28c. to 30c.
Nutmegs—16½c. to 17c.
Oranges—$3·00 per box.
Pimento—16½c. to 17c. per lb.
Sugar—Centrifugals, 96°, 7¾c.; Muscovados, 89°, 6¾c.; c. &f., Molasses. 89°, 6¾c.

Special Selected Sea Island Cotton Seed

— FOR —

PLANTING PURPOSES.

We can supply you with the above, selected from Seed grown at the Government Industrial Schools, and the Lunatic Asylum Farm, under the supervision of the Agricultural Department. Lint from this Seed has been highly reported on by the Spinners in England.

WE SOLICIT YOUR ORDERS.

The Barbados Co-operative Cotton Factory, Ltd.

WHITE PARK.
May 15, 1920.

AGENTS FOR PUBLICATIONS OF THE IMPERIAL DEPARTMENT.

London: Messrs. Dulau & Co., Ltd., 34-36, Margaret Street, Cavendish Square, W.
West India Committee, 15, Seething Lane.
Barbados: Advocate Co., Ltd., Broad Street, Bridgetown.
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British Guiana: The Argosy Co., Ltd., Georgetown.
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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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Scientific Research in Relation to Agricultural Problems.

AT the organizing convention of the Canadian Society of Technical Agriculturists, held in June 1920 at Ottawa, an address was delivered by Prof. W. P. Thompson, of the University of Saskatchewan, dealing very clearly and forcibly with the importance in modern days of research workers in agricultural subjects. The main points of this address seem well worthy of presentation and interpretation.

Agricultural scientific research suffers more than any other form of industrial research from a lack of realization on the part of the general public of its possibilities. This is perhaps due to the familiarity with agricultural problems on the part of those who reside in agricultural communities. The value of research in relation to manufacturing industries is generally admitted, perhaps because of the mystery which still surrounds the subject of chemistry in the minds of most people. But with regard to agriculture, it seems to be held that there is no real need for investigation into such commonplace operations as ploughing, planting, and reaping.

In reality, agriculture, like other industries, has reached a stage at which little further progress can be expected from casual observation or the accumulation of experience derived from rule of thumb experiments. Future progress will result only from the careful application of scientific facts and principles to agricultural problems, which problems are just as difficult and complex as those of any other industry. The actual financial benefits which have accrued wherever scientific agriculture has been properly applied are not surpassed by those in any other industry.

The problems, the investigation of which is likely to result in departures of importance, demand, however, knowledge of an unusually wide range of fundamental subjects, and agricultural research is therefore peculiarly dependent upon so-called pure science The workers in these fundamental subjects supply, so to speak, the raw material of definite scientific infor-

mation, while the technical agriculturists work up the manufactured article of improved agricultural practices. Reliable information on the latter point can then be supplied to planters or farmers by actual demonstration.

There should be effective co-operation between the research worker and the practical agriculturist, and the former should receive as much stimulus from the latter as the latter from the former. The practical man knows the problems, and discovers wherein information is lacking in order to solve them. He should be able to enlist the services of the scientific research worker as to their solution; and frequently, by so doing, the practical man discloses to the research worker the need for detailed investigation into some fundamental subject, which may well result in an advance in theoretical science.

In order to grapple with the majority of agricultural problems, the need of team work becomes evident. A number of experts attacking a problem conjointly in various directions bring to bear on it so many different points of view that danger of failure to find out at least something of importance about the subject is greatly minimised. It should not be imagined, however, that co-operation between experts can replace individual research, but it can make the individual research worker much more effective in solving certain problems. Numerous problems come before the notice of agriculturists, and some of these can, it would seem, only be tackled successfully by individual workers. Consequently it should not be laid down as an inflexible rule, that all problems are best attacked by team work. Problems which are easily outlined, clearly defined—which possess a high probability of successful solution when vigorously studied, and which are of such a nature that the methods of attack are fairly obvious, yield most readily to team work. On the other hand, problems which are somewhat vague, or which are of the type that promises little in the way of directly successful solution, are best undertaken by an individual worker of especial ability, perseverance, and imagination, for in such a case the work cannot be outlined sufficiently clearly to allow of the allocation of different phases of it to different experts. In an institution, therefore, for the furtherance of research there should always be a place for such in dividual workers, with substantial financial aid, and with freedom from other duties.

In Government departments and institutions, there has hitherto seemed to be a tendency to cramp and hinder some of the individual types of research workers, by insisting upon a clear definition of the object of the work before it has been begun, and by periodical demands for a statement from each research worker of his progress and findings. In teaching institutions, as in many of the universities, these limitations do not exist to any extent, and the value of the freedom resulting is shown by the final results of the system when they are examined. When a research worker is in a position to devote his time and attention to research, without giving miuute statements beforehand of his object, he is more likely to break new ground than if every research has to be justified in advance. A research worker ought to be perfectly free to choose his problems, and to determine how far he may follow up his research work. One of the chief attractions in such work to the enthusiastic worker is that he seldom knows where a line of investigation is going to take him.

It would appear advisable for research workers in fundamental scientific subjects to make a judicious choice of problems and materials before commencing a definite piece of work. In agricultural research, for example, a plant physiologist could just as well make use of a crop plant of economic value in examining into certain phenomena, as employ a plant of no economic interest. By so doing he is quite likely to reveal, perhaps incidentally, perhaps directly, information of great practical importance concerning the plant which he is investigating.

The subject of the nature of the work of scientific agricultural research workers deserves some allusion to the remuneration which such scientists should receive. The agricultural research worker labours under a certain disadvantage, in that he does not share in the financial benefits which accrue from his work, as is the case, in part at least, with the industrial research worker. Although the work of the agricultural research worker may result in much financial benefit in the cultivation of particular crops, it is not likely that he will profit at all, or only very slightly, from the results of his researches. If able research workers are to be attracted by, and to be retained in the persuit of the solutions which agricultural problems demand, the remuneration given to them, in order to allow them freedom to attack those problems with success, ought to be sufficient to make possible a life of decent comfort.

THE WATER FACTOR IN CROP PRODUCTION.

In many places water is frequently a seriously limiting factor in crop production. In order to cope with this problem there are two chief points of attack: (1) selecting plants adapted to local conditions; (2) adjusting the water factor of the environment to the needs of the plant. It is only by employing both methods that the desired end will be attained. Much has already been done in the production of drought-resistant strains. The globe has been searched by the experts of the United States Department of Agriculture for suitable plants, which after careful selection, and where necessary, hybridization, are put under cultivation. Wheat, for instance, can now be grown in many of the more arid parts of the United States, where formerly it was unknown. The type of plant which passes into a dormant stage during dry spells, and which will renew growth without having been greatly injured when the rains come, is greatly to be desired. Certain of the sorghums appear to possess this character.

The adjustment of the environment, on the other hand, to the needs of the crop, has always presented great difficulty. It is only in regions where irrigation is possible that anything approaching satisfactory control of the water factor can be attained. In other districts it is necessary, if the rainfall is limited, to resort to the methods of dry farming. Mulching the surface of the soil for a few inches in depth by stirring it has been practised from the earliest times as a means of conserving the moisture of the soil. Moisture evaporated from the soil is of course completely lost, and is of no value to the crop. The best condition would be to have no evaporation of moisture except that passing through the plant, and assisting in its functions. Evaporation not only depletes the soil of its moisture, but is liable during dry spells to cause a dangerous concentration of salts in the surface layers. The colour of the soil is claimed by King to affect evaporation greatly, since the darker the soil the more heat it absorbs. Ridgeway has shown that stirring the soil to a depth of 2, 4, and 6 inches once a week, with the water level kept 22 inches below the surface of the soil, lessened evaporation by 19, 23, and 45, per cent. respectively of the amount from the unstirred soil. Harris and Robinson point out that the dirt mulch loses its efficiency unless it is kept dry.

The advantages attending the use of a trash mulch in the cultivation of the sugar-cane are now generally recognized; not only is the moisture in the soil conserved by this form of mulch to a very large extent, but the development of excessive soil temperatures during the hottest part of the day is prevented. Excessively high temperatures are developed in the absence of trash, particularly on the darker classes of soil, even to a considerable depth. It is most instructive in this connexion to feel the soil with the hand under the trash, and in the open. High temperature in the soil not only dissipates the moisture of the soil, but retards the absorption of water by the roots in the upper regions of the soil at the very time of maximum water loss from the leaves. The affect of the mulch on the conservation of the humus, and on all the physical, chemical, and biological activities of the soil, which determine the fertility of the soil, is as yet unknown. An objection which is sometimes raised against the use of trash, is that it prevents light showers of rain from finding their way into the soil. A moment's consideration shows, however, that even if the trash were absent, and such rains did enter the soil, not only would they be evaporated before the roots could utilize the water they bring, but they would assist in the dissipation of the water already in the soil by linking up with the water films beneath the surface and so leading to increased capillary movement.

Thus far the losses due to the water transpired by the crop have not been considered. Economy in this direction is, however, very great. The use of wind-breaks, and the advantage of planting the rows in the direction of the prevailing wind are too well known to require emphasizing. Kiesselbach, who carried out his work in Nebraska, points out that in a fertile soil there is a smaller loss of water per unit of dry matter than in a relatively infertile soil. This does not mean of course that under optimum conditions of soil fertility, less water is required per plant or per acre. In fact, it appears to mean just the reverse. For example, as one adds manure to an infertile, unproductive soil, one may greatly reduce the water required per unit of dry matter produced, but at the same time the total amount of water transpired may actually be increased. The ratio of water loss to dry weight is lower because the plants grow in a more normal manner. Anything below the optimum fertility approaches a pathological condition. The plants grow more luxuriantly in a fertile soil, having a greater leaf area, and consequently each plant requires a greater total amount of water. Under these conditions, if the rainfall is limited, what would be the result of adding fertilizers? It would not mean that the plants could endure dry weather better by requiring less water, but it would mean a greater total water requirement per plant, and the crops would tend to withstand the shortage of moisture less well than if no manure had been added. Thus, in regions of limited rainfall an application of manure or other fertilizer might be expected to cause even greater injury from a lack of moisture than if none at all had been applied.

There is one manner, however, in which this reduced water requirement in the production of dry matter by the plant, due to the increased fertility, may be taken advantage of under conditions of limited rainfall. If the plants were spaced farther apart upon the land, relatively more water would be available in the soil for the amount of growth it supports. Manure might then be applied, thereby combining for the individual plant a greater abundance of moisture and a greater production per unit of water transpired, resulting from increased fertility. There would doubtless be a counter tendency for more water to be lost by evaporation directly from the soil surface, because of less protection given by the crop. This would be met by frequent stirring of the surface soil, or by mulching with trash, grass, leaves, etc.

Another suggestion of possible practical value for certain crops, e.g. maize, under semi-arid conditions, is that of Cunningham, to space the rows twice as far apart as is commonly practised, with double the usual number of plants in the row. The principle involved is that the plants will be reduced in vegetative growth because of competition, and the roots may continue to grow into the moister soil between the rows. The idea of obtaining a greater return from the moisture in the soil by increasing the fertility, and the methods suggested for obtaining this end are new, and worthy of the most careful experimentation.

T.G.M.

SUGAR INDUSTRY.

SUGAR NOTES.

The following abstracts are of other papers read at the meeting of the Sugar Section of the American Chemical Society, reported in *Facts About Sugar*, referred to in the previous issue of this Journal.

2. THE USE OF KIESELGUHR IN THE CLARIFICATION OF CANE JUICES. H. S. PAINE AND C. F. WALTON.

In attempting to determine the relative values of various samples of Kieselguhr for filtering cane juice, it was found that the determination of the purity of the filtered juice was not sufficient, as but little difference occurred. The method found best adapted was to measure the amount of colloidal matter removed by the Kieselguhr from the solution, as freedom from colloidal matter renders the juice easier of treatment.

For the experiments the authors used a cane syrup of 25-28° Beaumé, which had been prepared from undefecated cane juice by heating, skimming, and evaporating. This was subsequently diluted to 16·47° Brix, and used in 200 cc. portions for the determinations. A small percentage of Kieselguhr was heated with the cane juice, and the mass subsequently thoroughly dialysed through a collodion membrane, and the residual matter dried and weighed. Ten to 15 per cent. of the original colloidal matter was thus removed by Kieselguhr alone. That remaining was identical with that left after filtering through a paper. Eighteen per cent. removed no more than did 5 per cent. Six per cent. of Norit after 5 per cent. of Kieselguhr removed nearly all the colloidal matter. It will do as well alone.

Porous Kieselguhr was found to work better, than a dense variety, filtering twice as fast. Fullers' earth removed very little of the colloidal matter.

Precipitating iron with phosphates removed some of the colloids. Iron was removed from the Kieselguhr by means of N/100 acetic acid, but the amount so removed was so small as to show there was no danger from this source. From 0·103 to 0·116 gram of colloids was removed from samples of the liquor. After filtering through paper, from 0·89 gram to 0·94 gram was found. After boiling and settling, 0·88 gram was found.

3. A REPORT ON THE SUGAR INDUSTRY OF FRANCE SINCE THE WAR, BY T. H. MURPHY.

Seven per cent. of the invested capital in the devastated region of France was in the sugar industry. Out of 217 factories, 142 were destroyed, representing 66 per cent. of the production capacity. This will leave an annual shortage of 716,000 tons of sugar for France.

All copper, brass, bronze, and electrical equipment was removed from these factories, and in most cases the plants were reduced to a mass of tumbled walls and twisted iron. It will require 89 million dollars to rebuild these factories, and the progress will be slow through scarcity of materials and of money. On the other hand, one-half of the 7 million acres of devastated land has been replanted.

Nearly all the factories had juice annexes for pumping juice to the central plant; 93° rendement sugar is made, which is later refined by the Adant process, making principally loaves, cubes, and tablets.

4. THE ACID HYDROLYSIS OF SUGAR-CANE FIBRE AND COTTON SEED HULLS. E C. SHERRARD AND G. W. BLANCO.

When materials such as sugar-cane fibre and the outer hard coatings of certain seeds or fruits, which consist almost entirely of cellulose, are heated with acids or alkalies in the presence of water, chemical decomposition occurs by which sugars are produced. The chemical reaction is known as hydrolysis. During an investigation, sugar-cane fibre and cotton-seed hulls were hydrolysed by digesting with dilute sulphuric acid under 115 to 120lb. steam pressure.

About 27 per cent. of total sugar was obtained from the bagasse, and about 14 per cent. from the cotton seed hulls. Of the sugar obtained from these materials very little was fermentable, the greater proportion being xylose.

The yield of sugar from bagasse, using Hudson and Harding's method, was 21·22 per cent. of the original dry fibre. Of this, 57 per cent. was obtained as crystalline xylose, and shown to be identical with that from cotton-seed hulls.

Attention is called to the fact that pentose sugar influences the equilibrium established in the hydrolysis of cellulose of hexose sugars. When present in sufficient quantities they prevent the formation of fermentable sugars.

It is pointed out that bagasse is a promising source of xylose or furfural.

5. SOME CHARACTERISTICS OF IMPORTED CANE-SUGARS. C. A BROWNE.

Proper curing of raw sugar, in order to prevent a falling off from standard, requires more attention than it has been given, in view of the fact that the tendency in the past has been toward the production of a 96 degree test sugar. The total importations of sugar of 96 degrees test increased from 56·2 per cent. of the total importations of 1911 to about 75 per cent. of those of 1916, since which time the percentage has remained uniform.

The average polarization of sugars for each month of the year follows a regular curve, being the highest in April with an average of 96° and then falling off to October, where a minimum of 94·5° is reached. This decrease of 1·5 per cent. is due largely to deterioration of sugar in the warm summer during storage or transit. If raw sugars were cured properly, the loss from deterioration could be prevented, and the percentage of sugar testing 96 degrees increased to 80 or 83 per cent.

The various tropical countries produce raw cane sugars of such definite characteristics that chemical analysis, physical appearance, or biological examination will in many cases establish the origin of the sugar. The raw cane sugar of British Guiana, for example, has its reducing sugars in an optically inactive form. Certain localities impart peculiarities to the composition of the ash of sugars. The various contaminating impurities in raw sugar sometimes influence the shape of crystal. These impurities may consist of gummy ingredients from fermented sugar-cane, of dirt and fibre particles from imperfect clarification, or

of products formed by the swarms of yeasts, bacteria, moulds, and other fungi which always exist in raw cane sugar, and frequently exert a destructive action upon the sucrose.

Raw cane sugars may also at times harbour insects, such as ants, beetles, etc. The sugar mite (*Acarus sacchari*), which has been reported of general occurrence in muscovado sugars, seems to be largely absent from modern centrifugal sugars. Shipments of raw sugar have been condemned owing to the presence of worms; in two such cases the worms were identified by the United States Bureau of Entomology as the larvae of *Piophila casei* and *Dermestes vulpinus*, which had crawled into the sugar for pupation from bales of hides that were stored near by. These larvae do not feed on sugar.

During the past year of scarcity and high prices, considerable unrefined plantation white sugar has been imported for direct consumption. Some of this sugar consisted of ordinary centrifugal sugar that had been washed to remove the film of adhering molasses, and then shipped in an undried condition. Such sugars deteriorate very rapidly, and large losses from inversion of sucrose have resulted during shipment and storage. Washed sugars when dried, either by steam or by mechanical driers, keep well. The lower grades have a polarization of about 99 degrees, and are of a dingy gray colour. If suitable care is used in manufacture, plantation white sugar can be made of brilliant whiteness, with a polarization of 99·8 degrees to 99·9 degrees. The lower grades of plantation white sugar contain ½ per cent. or more of mineral and organic impurities, which frequently give trouble to the candy and syrup manufacturer. In times of greater abundance, when the purchaser is less limited in choice, these lower grades of white sugars will find little demand for direct consumption.

AGRICULTURE IN BARBADOS.

Ideal weather prevailed during the last fortnight of October, and the rainfall during this period has been nearly four times greater than that of the first half of the month.

The rainfall for October in the red soils has been so far 6¼ inches; in the black soils, 4½ inches. The rainfall for the year amounts to 42¾ inches, and 27½ inches, respectively, as against 43 inches and 35 inches last year. The recent rains have been a great boon to the island.

It is worthy of note now, that many fields of ratoons are failing, and the digging up of bad fields is being continued. This has not been in some cases the direct result of a poor rainfall, but of the folly of not adopting a proper system of rotation, and the resulting poverty of the soil. Wherever a good field of ratoons can be seen in the island, it is the direct result of proper cultivation, and a liberal application of farmyard manure.

The cultivation for the planting of the crops has not been completed yet ither in the black or red soils. The fields in the black soil estates are nearly ready; in fact, at one or two estates a few plants are being cut. In the red soils, the preparation fields at some estates are full of grass and weeds, owing to the difficulty in getting sufficient labour. Farmyard manure is being applied wherever it is ready, and field pens are being forced as rapidly as possible.

In the red soils most planters are bent on planting the major portion of their fields in the B. H. 10 (12). This seedling has stood its test this year, and has shown its superiority over the other seedlings.

Very few fields are to be seen immune from disease of some sort. A fair trial should be given of plants cut from first ratoons, as several fields which were planted from first ratoons are doing well.

The yam crop at present is very moderate, owing to the very dry weather which existed during the first half of October. This is the month when the yam develops, and if hindered in its development, the yield will be disappointing. The planting of potatoes to satisfy the provisions of the Vegetable Produce Act seems to be in full swing, and those already planted are growing well. The eddoe crop is a fair one. Many fields of white eddoes are flowering. This occurs when fresh suckers are being put forth. Indian corn is now being retailed at 5c. per pint. The supply this year is not a very large one. (The Barbados *Agricultural Reporter* October 30, 1920.)

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. VINCENT. Besides the usual routine work in the Botanic Garden and Experiment Station, Mr. T. Jackson, the Agricultural Superintendent, writes that in the month of September, plots for experiments of various kinds have been planted or prepared. The following plants have been distributed during the month: 20 grafted mango plants, 12 Manila hemp plants, 2,400 sweet potato cuttings, and 6 vanilla cuttings. On September 13 the weather was stormy, with strong winds from the south-east, but very little serious damage was done to any crop. Picking from early fields of cotton has begun; on the whole this crop looks promising. Generally speaking, active measures have been taken by planters to control cotton stainers. The rate of increase of this pest is not at all alarming. Some estates still continue to be free. Aphides have practically disappeared. Some bud-shedding of cotton took place during the month, which was probably due to the high winds alluded to above. Little loss, however, has accrued. The condition of the sugar-cane crop appears to be normal. It is gratifying to observe that large areas are now being cultivated in ground provisions. It is estimated that about 2,500 acres are under such cultivation, inclusive of ground nuts. Local foodstuffs and fruit are fairly plentiful. Corn is being reaped, and 18,863lb have been purchased at the Granary, and 14,418lb dried there. During the year 1919-20 St. Vincent produced 456,779lb of clean Sea Island cotton, and 18,871lb of stains. This gives an average of 93·5lb per acre, which is slightly less than that of the previous season. During the same period 77,540lb of clean Marie Galante cotton was produced, together with 8,187lb of stained, or a return of 51lb per acre. The rainfall for the month at the Experiment Station was 9·85 inches, and at the Botanic Garden, 12·50 inches.

DEPARTMENT NEWS.

Sir Francis Watts, K.C.M.G., Imperial Commissioner of Agriculture for the West Indies, left Barbados on November 10 by R.M.S. 'Chaleur' for Dominica, on an official visit. He is expected to return in a fortnight's time.

A REPORT ON MALARIA IN TRINIDAD AND TOBAGO.

The following is a review of a valuable report by Dr. C. F. Lassalle, Deputy Surgeon and Medical Inspector of Health of Trinidad and Tobago, on an anopheles survey of the colony, which has been recently submitted to the Government. The report bears the heading 'Malaria:' Part 1 is Council Paper No. 89, and Part 2, Council Paper No. 129, both of 1920.

The surveys on which this report is based were made during two periods—between March 15, 1914 and April 30, 1915, and again from July 1917 to December 31 of the same year. The surveyors were all qualified sanitary inspectors with special training in anopheles survey work, and with a practical knowledge of measures for mosquito eradication. District Medical Officers exercised a general supervision over the work of the inspectors, inspected their diaries once a week, and forwarded their weekly reports, with observations on the same, to the Surgeon-General. The special instructions to the Inspectors contained the following:—

'1. A detailed search must be made for collections of water. Every collection of water, and every receptacle liable to collect water (holes in trees, water-retaining plants) should be carefully examined. Whenever larvae are found, specimens should be collected and bred out for the identification of the species.

'2 Notes must be made at the time of the particulars of the breeding places—nature and extent, sources of the water, the use, if any, to which the water is put, etc. The methods by which the breeding places might be got rid of or controlled should also be considered and noted.

'3. Low-lying ground or irregular flat lands adjacent to high ground, which become or are liable to become flooded during the wet season, should be examined, and the character, extent, etc., noted.

'4. Diagrams of the district, as accurate as possible, should be made, showing with reference to an index:—

(a) Breeding places, distinguishing between permanent, temporary and potential.

(b) Villages, estates, houses, settlements, with the approximate distances from breeding places.

(c) Main line of drainage, and roads.

'5. As far as practicable the habits of mosquitoes should be studied. Houses should be examined, and notes made of the distance from breeding places.

6. A diary must be kept of the work done, and a summary made at the end of each week.

'7. On completion of the survey, a connected report should be written up, comprising the facts ascertained, and a general description of the physical characters of the district.'

There were employed on this work five inspectors during the first period, and eight during the second. Four of the inspectors were employed during both periods. From the instructions to the inspectors the nature of the survey work is plainly to be seen.

The body of Part 1 of the report gives records of the surveys of the different districts in Trinidad and Tobago, showing the nature of the mosquito breeding places, and giving recommendations for the improvement of the conditions with regard to mosquito control. Pages 43 to 51 give general observations, summary, and recommendations.

Several sectional sketch maps showing breeding places in different localities are included in Part 1. On these maps breeding places are indicated as permanent, temporary, and potential, and the breeding places of some of the most important malaria-carrying mosquitoes are indicated.

The sketch map of Trinidad at the end of Part 1 indicates where mosquito breeding places were found throughout the island.

In the chapter of general observations, summary, and recommendations, the list of breeding places of anopheles which were found during the course of the survey is of interest.

The most important result obtained by the survey has of course been the relation of breeding places to towns and villages, and other considerable centres of population. The districts which were found to be most infested were Chaguanas, Caroni, Oropuche, and La Brea in Trinidad, and Roxborough, Tobago, all well-known malarious localities.

The ideal breeding grounds of anopheles here, as in other countries, are natural collections of water protected from strong light, and renewed by fresh supplies.

The propagation areas found in the course of the survey may be summarized as follows: 1. Slowly running water courses, streams and rivers. 2. 'Seepage' water. 3. Pools and ravines. 4. Ponds, lagoons, swamps. 5. Brackish waters. 6. Low-lying, swampy and grassy lands. 7. Rice fields. 8. Shallow wells and water holes. 9. Mosquito breeding places produced by man: (*a*) borrow pits at the sides of roads and railway lines; (*b*) tapia holes, i.e., holes from which clay has been obtained for building huts; (*c*) culverts—if badly laid. 10. Earthen street and road drains improperly graded or blocked. 11. Water containers, such as old disused coppers, etc. 12. Hoof prints of cows and horses especially in pastures. 13. Wheel tracks of wagons or carts.

Although other species have been found commonly breeding in the stems of plants, the two species, *Anopheles albipes* and *A. argyrotarsis*, which convey malaria in the colony, have not been found breeding in such places.

REMEDIAL MEASURES.

Under this heading, the following statements and recommendations are given:—

'When malaria can be practically extinguished in such a place as the Panama Canal Zone, the same thing can be done anywhere else. Gorgas's fundamental principles in order of importance are:—

'(1) The habitat of anopheles during the larval stage is destroyed within a hundred yards of dwellings, since the larvae of this mosquito live only in clear, fresh water which is plentifully supplied with grass and algae.

'(2) All protection for the adult mosquito must be destroyed, since the adult is weak on the wing, not generally flying far, and needing plenty of grass and bush for protection against the wind.

'(3) All habitations are screened, but effectively, for screens as ordinarily put up without expert supervision are of little use.

'(4) Where breeding places cannot be destroyed by drainage the larvae must be destroyed by means of crude petroleum or some other larvicide.'

These principles are not difficult of application, and all remedial measures should be based on them.

Measures for the eradication or reduction of anopheles mosquitoes may be grouped under the following headings:—(1) Filling of pools, depressions, swamps. 2. Drainage (agriculture). 3 Oil or petrolization. 4. The use of larvicides. 5. Natural enemies. 6. Cleaning bodies of water. 7. Screening of houses and destruction of adult mosquitoes in houses.

Limitation of space will not allow of comments on all these points, but some of them deserve special mention.

For instance, it is stated that 'proper drainage is the most effective method of eliminating malaria,' and again, 'it has been proved in other countries that agricultural operations are powerful antagonists of malaria, and that the disease is reduced or banished from low-lying, unhealthy places in proportion to the thoroughness and efficiency of those operations.'

Proper drainage depends on the right construction of drains, and their maintenance in such a manner that while surplus water is promptly removed, there are no pools or obstructions in which small quantities of water remain as mosquito breeding places. Drainage is fundamental in low-lying lands or in any moisture-retaining soil, as a requisite for agriculture, and such operations as ploughing or forking the surface soil tend to make it porous, and to allow water to penetrate instead of remaining on the surface.

The natural enemies of the adult mosquito are stated to be dragon flies and bats; and reference is made to the recommendation that has been put forward in some countries to encourage the breeding of bats on a large scale. In such cases, in addition to the reduction of mosquitoes, there would be quantities of bat guano available as a fertilizer.

The natural enemies of the mosquito larvae are the larvae of the dragon fly, and several kinds of small fish, especially 'millions,' 'guabin,' 'sardine,' and 'coscorobs.'

The writer of the report draws attention to the fact that in typical anopheles pools and water collections the larvae can easily escape from the fish among the growth of algae, grasses, and other vegetation. These fish are of but little use in controlling mosquitoes, except in water fairly free from vegetation, and with clean, smooth sides and borders.

As for rice fields, which are of importance and cannot be abolished, methods are suggested for reducing the danger of malaria from these. No settlement should be allowed in the rice field, and houses should not be nearer than 200 yards on the windward side, or 400 yards on the leeward side of the rice fields. Experiments with fish should be carried out, and trials should be made in the periodical drying-out of rice fields, which, it is said, may be done in such a way as not to injure the crop.

The general summary of recommendations is given below:—

1. All surface drains in villages should be properly graded to a suitable outfall into the nearest watercourse or into the sea, and concreted as far as funds may permit.

2. Unpaved earth drains or ditches should be kept free of vegetation, and where small pools of stagnant water form and cannot be drained, oil should be applied to the surface regularly once a week.

3. All low-lying, swampy lands near villages and at a distance of at least 400 yards should be filled in or drained, or both, as found necessary.

4. All useless, shallow wells and ponds should be filled in; until they can be so dealt with they should be regularly oiled once a week.

5. Wherever practicable a pipe-borne constant water-supply should be introduced in every village. This would render it possible to do away with shallow wells and water holes, as well as cisterns and tanks.

6. Wherever such a supply is not possible, the efficient screening of all water receptacles should be secured; advice and instruction in the cheaper methods of screening and, if necessary, the enforcing of anti-mosquito bye-laws would have the desired effect.

7. Borrow pits should be filled in, or, where very extensive, efficiently drained towards the nearest watercourse.

8. No new borrow pits should be made anywhere in the neighbourhood of residential settlements, e. g., villages, and estates, unless provision is made for thorough drainage.

9. The current of streams should be accelerated by the regular removal of obstructions, e. g., vegetation, debris, etc., and the courses being straightened and properly drained wherever possible.

10. In the vicinity of villages and estates, water collections which cannot be immediately dealt with should be oiled once a week, or fish should be put into them.

11. Legislation for drainage of swamps and lagoons wherever injurious to health.

12. The early making of anti-mosquito bye-laws, similar to those now in force in urban districts, applicable to all rural districts.

This must be considered as an extremely valuable report—valuable not only as showing what the mosquito conditions in Trinidad and Tobago are, and what means may be taken to make effective a campaign for the greater improvement of conditions in that colony, but also, what is perhaps still more important, as setting an example which ought to be followed in each and every island of the West Indies where mosquito-borne diseases, especially malaria, are prevalent. Indeed, when one considers the amount of inefficiency and the loss of available effort in the West Indies during the past twenty years, although the relations of mosquitoes to malaria as well as the means of mosquito control have been well known, it seems remarkable that surveys such as that described in the report under review, should not have been carried out in all the West Indian colonies long before this time.

PRODUCTION OF SYNTHETIC NITROGENOUS COMPOUNDS IN GREAT BRITAIN.

The final report of the Nitrogen Products Committee, appointed by the Ministry of Munitions in June 1916, contains matter of importance to agriculturists. The value of nitrogenous fertilizers is being recognized more and more as time goes on. The question of the probable cost of artificially prepared nitrogen compounds, in comparison with the cost of natural nitrogenous products, should arouse considerable interest.

It has been shown that a metric ton of nitrogen gas can be separated from the air by modern liquefaction processes for less than £1. The market price of a metric ton of combined nitrogen in the United Kingdom prior to the war varied from £66 to £67 (in the forms of ammonium sulphate and Chile nitrate, respectively). The synthetic processes can produce a metric ton of combined nitrogen at a cost from the factory of from £20 to £30, whereas the lowest recorded market price in the United Kingdom for a metric ton of combined nitrogen (as ammonium sulphate) was £35 8*s.* in 1897. The synthetic processes can produce a metric ton of concentrated (93 to 96 per cent.) nitric acid for about half the cost of the Chile nitrate retort process, and a metric ton of combined nitrogen, ready for the fertilizer market as cyanamide or ammonium sulphate at a cost at the factory of about, or even less than, one-half the pre-war market price of combined nitrogen in the United Kingdom.

The synthetic processes, with the exception of the arc process under favourable conditions as regards cheap water power, are not regarded as in a position to produce nitrate fertilizers at a sufficiently low cost to face the possible competition of Chile nitrate.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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Agricultural News

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NOTES AND COMMENTS.

Contents of present issue.

The editorial deals with the position of scientific research in relation to agricultural problems.

Under Insect Notes, on page 362, will be found an important warning as to the imminent danger of invasion by the pink boll worm of cotton into the West Indies, and on page 363, a résumé of proposed legislation in Jamaica with the object of eradicating ticks.

The importance of the water factor in crop production is the subject of an article on page 355.

A valuable report on malaria in Trinidad and Tobago is reviewed on page 358.

On page 366, a note on the recent investigation and experiments concerning the mosaic disease of sugar-cane will be found.

The 'West Indian Bulletin,' Vol. XVIII, No. 3.

This number, which has just been issued, contains articles of value and interest. The first is by the Hon. J. B. Harrison, C.M.G., Director of the Department of Science and Agriculture, British Guiana, in which he describes the genesis of a fertile soil. In it the writer describes the composition of the soil of Barbados, a subject which he has made peculiarly his own, and bases his conclusions on a long series of personal observations. He believes, after careful consideration, that the fertile soils of Barbados have originated directly or indirectly from the air-borne debris of the volcanic vents of other West Indian islands. To anyone interested in geological problems the paper will afford much pleasure.

Following this first paper there is a note, also of geological interest, which gives Professor Harrison's identification of the composition of the pebbles deposited in a certain district of Antigua. These pebbles, as to their origin, are still a puzzle to geologists.

The next paper is a reproduction from the *Journal of the Royal Society of Arts* of a paper by Sir Francis Watts, K.C.M.G., Imperial Commissioner of Agriculture for the West Indies, which was read at a meeting of the Colonial Section of the Society. The subject is 'Tropical Departments of Agriculture, with special reference to the West Indies.' In this Sir Francis deals with the subject from the standpoint of an expert; his work in connexion with Departments of Agriculture in the West Indies is too well known to be further enlarged on.

The final paper in the number is also one by Sir Francis Watts. It is a résumé of the history and work of the Gunthorpes Sugar Factory in Antigua, from its inception fifteen years ago. Considering that the scheme of such a factory was originated by Sir Francis, and the carrying it out due chiefly to his efforts, there is no wonder that the success of its working is a source of satisfaction to him. The manner in which the whole working of the project has been efficiently carried out is lucidly explained.

West Indian Tropical Agricultural College.

At a meeting of the Executive of the West India Committee held on September 2, the following Resolution was passed:—

'That the Executive of the West India Committee has learnt with satisfaction of the encouraging manner in which the recommendations of the Tropical Agricultural College Committee have been received in the West Indian Colonies generally, and expresses the hope that now that the Secretary-of-State for the Colonies has decided that the College shall be situated in Trinidad, the scheme will continue to receive whole-

hearted support in those Colonies, all of which, it is confident, will derive incalculable advantage therefrom. This meeting further hopes that those colonies which have not yet come to a decision as to the extent to which they will support the College, will do so as early as possible, in order that there may be no further delay in inaugurating the scheme which has been launched under such favourable auspices.'

The Colonial Outlook.

At the seventeenth annual dinner of the Corona Club in London, the Right Honourable Viscount Milner, G.C.B., K.C.M.G., His Majesty's Secretary-of-State for the Colonies, presided, and made a forcible speech on the position and prospects especially of the Crown Colonies. The following extracts from his speech seem of special West Indian interest. Lord Milner said: 'There are many of these countries, notably the West Indies, West Africa, Ceylon, Mauritius, Malaya, which have done extraordinarily well during the last few years, and which have a very good financial outlook. But it is not the purely financial side of the matter which appeals to me. I attach equal importance to the fact that, owing to this greater prosperity and these brighter prospects, there is among the people of these Colonies a spirit of greater hopefulness and enterprise than that which characterized them in the past days of economic depression. I could give many instances of that. I will only refer to one or two. There is, for instance, the project at present being so warmly taken up in the West Indies, of the establishment of an Agricultural College of University rank in one or other of the West Indian islands. That project, I feel confident, will be realized at an early date, and no one who knows anything about those islands or about our tropical possessions generally can fail to appreciate the immense importance to them all of the development of agricultural science. I can only hope, that the example of the West Indies in this respect will find emulation in other parts of our Empire which can well afford to do likewise.'

'One of the two great objects to be pursued on the material side of colonial development is the improvement of transportation. And the other which is like unto it, or even greater than it, is the application of science, and that above all in respect of health, the health of human beings, and the health of everything that grows out of the soil. Among the innumerable conferences and congresses which have been and are being held in London at this most crowded season of the year, there is one to which I think we members of the Corona Club ought to feel the greatest gratitude, and that is the Conference of Entomologists from different parts of the Empire. Their life work is connected with the study of the most minute creatures under the sun, but the benefits which have been derived and will be derived from their labours are absolutely immeasurable, both in respect of human health and the increase of the produce of the soil.'

Sesbania Sericea as a Green Dressing.

There is a leguminous shrub which occurs in the West Indies, pretty generally from Jamaica to British Guiana, especially on moist soils. Mr. J. S. Dash, Director of the Agricultural Station, Guadeloupe, forwarded specimens of this plant to the Royal Botanic Gardens, Kew, for identification. The authorities have identified it as *Sesbania sericea*. A note on the subject appears in the *Kew Bulletin*, No. 7, 1920.

Mr. Dash states that he is cultivating the plant esperimentally as a possible green dressing, because the nodules which he found on the roots, were superior in size and quantity to those of any other leguminous plant with which he is acquainted. The plants reach a height of 4 to 6 feet in good soil, but at that stage they become rather woody. If employed as a green dressing, it would probably be advisable to turn them into the soil at an earlier stage of growth. When from 2 to 2½ feet high they produce a heavy yield of green material, if sown thickly. From an analysis made in the Guadeloupe Laboratory, it would appear that the nitrogen content of the plant is very high. It seems therefore worth while experimenting with.

Prize Holdings Competition in St. Lucia.

The report on the working of this scheme for the year ended July 31, 1920, has recently been received at this Office from Mr. E. Buckmire, Acting Agricultural Superintendent.

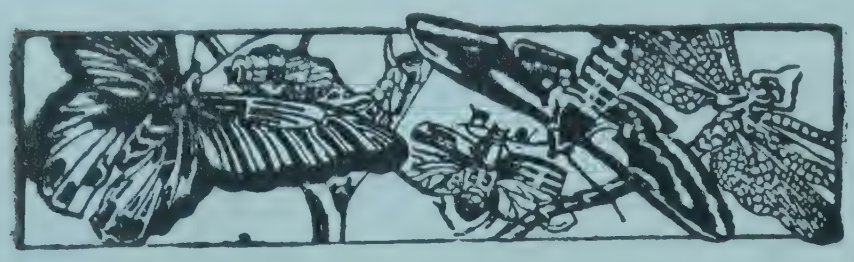
These competitions were originally started to encourage the extension of lime cultivation, and to improve the cultural methods of dealing with cacao among the peasant proprietors; they now include coco-nut cultivation, but only in the Castries district.

The total amount offered in prizes was £75, which was divided among the cultivations mentioned above in the following proportions: for cacao, £46 10s.; for limes, £24 ; for coco-nuts, £4 10s. It appears that this year's cacao competition was in respect of new plots which had not previously competed, and that great interest was shown by the competitors. A result has been that a considerable improvement in the care of older plots is to be noticed.

In the case of limes, the competition was for the continuation of methods laid down for practice in the previous year. In most cases the lime plots received careful, regular attention, and the young trees were healthy, and growing vigorously.

Interest in coco-nut cultivation is increasing, but the supply of nuts of approved types for planting, was insufficient to meet the demand.

It is evident that these competitions tend to stimulate interest among the small holders in improved methods of cultivation; and this must be for the permanent benefit of the industries concerned.



INSECT NOTES.

THE DANGER OF INVASION BY PINK BOLLWORM.

Few insects ever sprang into such a great and world-wide notoriety within a short space of time as the pink bollworm. Ten years ago this insect was known as a native insect infesting cotton seed in the Far East, possessing a capability of occasionally causing severe losses in the amount of crop. In Hawaii, it had at that time proved its capability as an introduced pest of almost completely putting a stop to cotton growing.

The pink bollworm was also established, and apparently generally distributed in the early years of the present century throughout districts in tropical Africa where cotton was being grown or experimented with.

Then in 1920 came its discovery in Egypt, followed by its rapid spread throughout that important cotton-growing country, and its invasion of Brazil, Mexico, and the Southern States.

So far as is known, the spread of the pink bollworm from its native localities in the Far East to the countries mentioned has been brought about by the distribution of infested seed, and while this perhaps continues the greatest danger of invasion of new localities, it is not the only means of spread which should receive careful consideration.

Readers of the *Agricultural News* will remember perhaps, the difficulty which arose when, in November 1918, a schooner arrived at Barbados with a mixed cargo, which included cotton seed from Brazil infested with pink bollworm. Not only was the cotton seed refused admission, but the whole cargo was regarded as contaminated by its contact with or proximity to the cotton seed, and none of it was allowed to enter the port.

This danger of contamination is a very grave one. The pink bollworms in the seed—the larvae—have the power to remain for very long periods of time quiescent, and then, acting under some stimulus, they, or some of them, leave the seed in which they have been resting, and crawl about until they find suitable places for pupating.

In the United States the officials of the Federal Horticultural Board, and of the State of Texas, fully recognize the danger of contamination.

In the cotton belt the pink bollworm danger presents two grave problems. One is concerned with the eradication of the pest from those localities where it has already appeared, at the same time preventing a further spread from these places; the other has to do with preventing reinfestation from the cotton fields in Mexico where this insect is thoroughly established.

A very comprehensive report on the pink bollworm is published as *Bulletin 65* of the Texas Department of Agriculture. This gives an account of all the work done in Texas for the control of this insect since its first appearance in that State, reproduces the legislative enactments under which action is taken, and reports various meetings of planters and others interested in the cotton industry in connexion with the struggle against the pest.

The invasion of the cotton belt by the pink bollworm is regarded with the gravest apprehension, and quite rightly so, and every possible precaution is being taken.

A non-cotton belt, about 50 miles wide, has been proclaimed along the Mexican border in Texas. This affects about 25,000 acres of cotton land. Total prohibition is declared against all cotton, cotton seed, and cotton hulls from Mexico.

In the case of railway trains which come from any pink bollworm-infested locality, these are not admitted into the United States, except that they may be permitted to enter transfer goods at the point of entry, where the cars and freight and express are inspected as to their containing or being contaminated by pink bollworm. Mexican cars may be reloaded with merchandise destined for points in Mexico, and returned to that country.

Freight cars which belong to the United States, on returning from Mexico are inspected, and, if necessary, fumigated. This may be done by means of live steam turned into the cars; but at several points on the border concrete buildings, capable of containing from one to fifteen cars, have been provided for the purpose of fumigating freight cars with hydrocyanic acid gas.

Passengers' baggage and personal effects are to be examined in such a way as to prevent the introduction of the pink bollworm by this means.

The attention which is being paid to the inspection of freight cars, perhaps of freight of all sorts, and the restrictions in the moving of all commodities from Mexico across the border into the United States serve to emphasize the difficulty which will attend quarantine work in connexion with pink bollworm if, and when, that pest gains access to any of the Lesser Antilles.

At present, cotton seed sent from one island to another for any purpose, but principally for crushing in the oil mills, is contained in bags, and usually shipped in schooners. If such seed were infested with pink bollworm, the bags which contained it, and the schooners which carried it, would need to be considered as being infested, unless adequate means were developed for their disinfection. Bags are used over and over again. A few infested seeds in a heap or bundle of these bags might be the cause of contaminating other bags, or even other cargo in the same hold. The pink bollworm, leaving the seed to pupate, might spin cocoons in the empty bags, but they might also travel to other cargo not ordinarily associated with cotton, and in the ordinary way not liable to suspicion in this connexion.

And in the matter of the schooners which trade between the islands, it is practically impossible to clean up all scattered seed from some of these schooners. Effective fumigation will be expensive, and next to impossible to accomplish. Infested seed scattered in these vessels will always be a menace. Pink bollworms issuing from such seed might attach themselves to cargo of almost any sort, and thus be introduced into a cotton-growing island.

It cannot be denied that there is danger of the pink bollworm being introduced by steamers which, having carried infested cotton seed to the United Kingdom, reload with general merchandise for these islands. There is a chance that scattered seed remaining in the hold might contaminate outward bound cargo, and an invasion brought about by this means, which would be very difficult to account for.

The fumigation or disinfection of bags which had been used for containing cotton should not present great difficulties, and might be arranged for in each island receiving such used bags in the event of the pink bollworm appearing in the West Indies either in the cotton fields or at the oil mills.

H. A. B.

PROPOSED TICK ERADICATION IN JAMAICA.

Combined efforts on the part of all cattle breeders and owners in any district are the only means to eradicate ticks from the fields, and to put a stop to the losses of stock due to their attacks. Unfortunately it is difficult to arrange such combined efforts, if they are left to voluntary action on the part of the stock keepers. Hence the proposed action of the Government in Jamaica in dealing with this question seems to be wise, considering the importance of the stock-raising industry in that island, and the serious losses which ticks cause, especially among cattle.

The Jamaica *Gleaner*, September 18, 1920, publishes the full text of a Bill which the Government has prepared on the subject. It is entitled: 'A Law to make provision for the control and eradication of ticks among cattle'.

After certain definitions of terms, the first three clauses run as follows:—

'(1) The Governor in Privy Council may make such orders as he may think fit for prescribing, regulating, and securing the periodical treatment of all or any cattle by effective dipping or by the use of some other means for the control and eradication of ticks, and any such order may be made to apply to the whole island or to any area defined in the order. By these orders different means may be prescribed for different areas.'

'(2) The Governor in Privy Council may, by the same or any other order as he may think fit, direct that the owners or occupiers of holdings on which there shall be cattle, shall construct dipping tanks sufficient for the effective dipping of all cattle on the said holdings, and it shall be the duty of such owners or occupiers to construct dipping tanks accordingly.'

'(3) Any such order may prohibit the removal of cattle from any pen, estate, or area named or defined in the order.'

Certain other clauses define the persons, whether owners or occupiers of lands, on whom the responsibility and expense of constructing dipping tanks shall rest. Other clauses state the penalties which failure to carry out the provisions of the law will entail.

One of the final clauses seems to be of imp rtance with regard to the successful attainment of the object sought for, should the Bill become law. It is as follows:—

'7—It shall be lawful for the Governor to cause to be constructed, from funds provided for the purpose by the Legislative Council, such public dipping tanks as he may consider to be necessary for the purposes of this Law, and, with the consent of any owner of a dipping tank, to declare by notice in the Jamaica *Gazette* such dipping tank to be a public dipping tank for the purposes of this Law, and the Governor in Privy Council may by orders made under section three of this Law regulate the use and management of public dipping tanks, and fix the charges payable by owners of cattle which are dipped in any public dipping tank, and such charges shall be recoverable by the Director of Agriculture as a civil debt.'

By the adoption of somewhat similar measures large areas in Texas and elsewhere have been rendered tick free, and undoubtedly a like result would follow the adoption of this law in Jamaica. It might be well if such an example were followed in other West Indian islands where also ticks are a serious pest.

A NEW METHOD OF SELECTING CANE FREE OF THE MOSAIC DISEASE FOR PLANTING PURPOSES.

Mr. C. W. Edgerton, Plant Pathologist, of the Louisiana Agricultural Experimental Station, describes in the *Louisiana Planter and Sugar Manufacturer* of October 1920, a new method of selecting cane free of the mosaic disease for planting purposes.

The disease, it is pointed out, is becoming so widespread in Louisiana, not only upon cane but also upon sorghum, corn, and a number of wild grasses, that there is but little hope of ever eradicating it completely. The most promising means of controlling the disease is by using only disease-free material for planting purposes. Disease-free material will produce healthy stalks, while if infected it will produce diseased stalks. If it were possible to plant only disease-free cuttings, and then to prevent the secondary infection, the disease could be eliminated. Consequently, any method of selection that will ensure disease-free material for planting constitutes a forward step in the control of the disease.

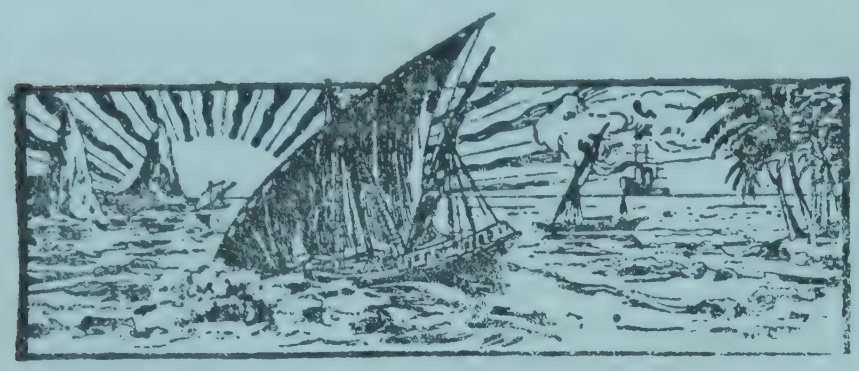
In some regions planters have imported cuttings from regions where the disease is not present. Such a method is expensive where much material is necessary to plant an acre. What is needed therefore is a method whereby cuttings may be readily selected on the plantation on which they are to be planted.

With the ordinary varieties of cane of Louisiana, in order to make sure that the stalks are not infected, it is necessary to examine the leaves before the stalks are cut and stripped. This is of course a tedious and slow operation. One variety, L. 511, has been found, however, in Louisiana, in which it is not necessary to examine the leaves, as the presence of the disease can be readily told from the stalks. This makes the selection of disease-free cuttings a comparatively simple matter. The healthy stalks of this variety are greenish in colour. They never show lines or stripes up and down the stalk. Red stripes, however, are always present on the diseased stalks, especially on the lower joints. These red stripes always run lengthwise, and vary in width from mere lines up to an eighth of an inch. The presence of a single one, however, indicates the presence of the disease.

In order to test the value of this method of selection, four rows were planted with cuttings selected in this way, and the adjoining four rows were planted with cuttings that showed by the red line on the stalk the presence of the mosaic disease.

In the course of the season the plots were examined at frequent intervals. The first examination showed there were only five diseased stalks in the four rows with selected, disease-free cuttings, while practically all of the stalks growing from the cane that showed red stripes had the disease. This low percentage of disease showed that this method of selection was entirely satisfactory.

It seems probable that in those ports of the West Indies where the ravages of the mosaic disease are seriously limiting the yields of cane, an examination will be rewarded by the identification of canes similar to the Louisiana variety described by Mr. Edgerton; should this prove so, the difficulties at present attending the selection of disease-free plants would be very largely eliminated.



GLEANINGS.

The reported discovery of potash on Vancouver Island is a subject of interest to Canada. The definite discovery of such Canadian deposits under conditions which would enable potassium salts to be mined and placed on the market at a price to compete with the European supply would revolutionize the fertilizer probelm of the British Empire. (*Production*, September 1920.)

Many people regard the nobs and odd twists that characterize the wooden handles of umbrellas as mere freaks of nature. As a matter of fact they are, in France for instance, the product of careful cultivation. The buds of saplings are nipped off, and by cutting the bark and training the shoots, almost any variety of design may be produced after a growth of three years or so. (The *Wealth of India*, June 1920.)

Although Canada imports large quantities of cotton textiles, the home cotton textile manufacturing industry is an important one. According to figures published by the Dominion Bureau of Statistics, Canada produces each year cotton goods amounting to $66,000,000. In 1918 Canada imported $77,308,202 worth of cotton, $34,000,000 of this being raw cotton. (The *Chamber of Commerce Journal*, October 8, 1920.)

The Jamaica *Gleaner*, September 17, 1920, states that in the report of the Deputy Island Chemist for the past financial year, it is stated that a number of so-called Scotch whiskies are being locally manufactured, attractively labelled and put on the market at a price of about 50 per cent. less than that of the genuine imported article. On analysis, a number of these so-called whiskies are found to be composed either wholly or in part of native rum together with flavouring matters.

With a view to display the resources of the British Empire, the Department of Overseas Trade recently arranged an Empire Timber Exhibition in London. One of the objects was to make known the uses, values, and costs of Empire grown woods. Every timber region in the Empire was represented. Ceylon and the West Indies sent a number of most interesting and scarce woods, some of them of much beauty and utility. (The *Manchester Guardian*, October 13, 1920.)

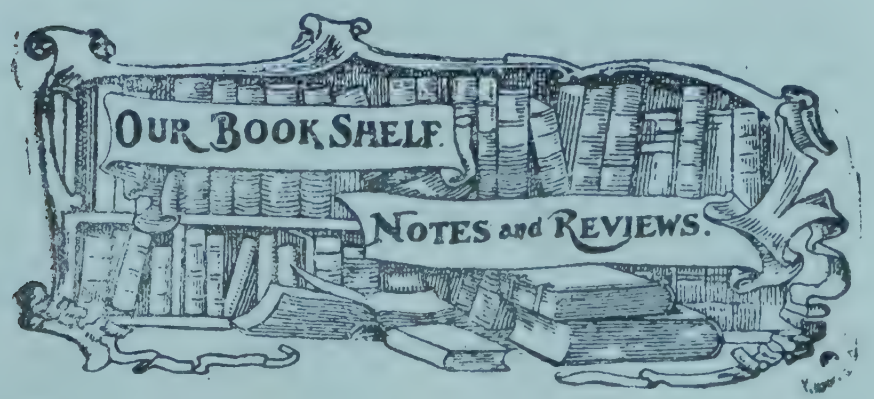
The President of the British Association, in his opening address at the recent meeting in Cardiff, states that it has been shown that the common edible animals of the shore might exist in such abundance that an area of the sea might be more productive of food for man than a similar area of pasture or crops on land. (*Journal of the Royal Society of Arts*, August 27, 1920.)

Some of the leading commercial people of Colombo are now engaged in formulating a scheme to start a paper mill at Colombo. Japanese competition is driving out English paper in India and Ceylon steadily, so that the development of paper manufacture in these countries is an imperial and economic need. Raw material is available in quantity in Ceylon. The annual paper demand of the island may safely be assessed at the value of Rs. 300,000. A local paper industry should prove a success. (*The Times* Trade Supplement, September 18, 1920.)

In a communication to *Poultry*, September 17, 1920, Dr. S. C. Harland refers to the fact that most of the poultry to be found in the West Indies may be considered as a mongrel assortment of practically all the well-known breeds in existence, together with the descendants of various breeds introduced by the early French, English, and Spanish settlers. He notices the hardiness of this mongrel race, and suggests that certain valuable qualities may have been preserved in it, so that it may be worth while for poultry breeders to experiment with crosses between these mongrels and the more prolific, but less hardy strains.

West Indian sugar producers seem to be subjected to some disabilities in developing the sugar trade to Canada, owing to the fact that the Dominion insists on applying the Dutch colour test to sugar imported by Canada. In a note in *The Times* Trade Supplement, October 9, 1920, it is pointed out that in order to protect the interest of Canadian refineries, the Dominion is clinging to an obsolete standard which has been abandoned by other countries in favour of the polariscope test. It appears highly undesirable that a foreign and privately prepared standard should be applied to sugar from one part of the Empire to another.

Mr. U. C. Loftin, of the Bureau of Entomology, was commissioned early in the year to make an investigation of the insect pests of cotton in Porto Rico, more particularly to determine if it is advisable to permit Porto Rican cotton seed to enter the United States for milling. In the course of his work he also investigated the cotton situation in San Domingo, at the request of the San Domingo Government. No pink boll worm was found either in Porto Rico or in San Domingo, but a large list of other cotton insects, most of them well-known enemies of this plant, were collected. A cotton-blister mite was found, which is not known to occur in the United States; and the occurrence also of certain cotton diseases in the island, notably an internal boll disease, which seems to be widely distributed through the West Indies, and is probably new to the United States, would seem to indicate the undesirability of allowing the cotton seed to come into this country. (*Journal of Economic Entomology*, June 1920.)]



BARBADOS-ANTIGUA EXPEDITION. Narrative and Preliminary Report of a Zoological Expedition from the University of Iowa to the Lesser Antilles under the auspices of the Graduate College, by C. C. Nutting. *Published by the University*, Iowa City. (Pp.274).

In the *Agricultural News*, Vol. XVII, page 156, the arrival at Barbados of a party of scientists from the Iowa State University, chiefly for the purpose of special marine zoological investigation around the shores of Barbados and Antigua, was noticed. Prof. C. C. Nutting, M.A., who was in charge of the expedition, has issued a preliminary report which we now have the pleasure of reviewing. This report forms one of the series of the University of Iowa Studies in Natural History, of which Professor Nutting is the Editor.

The expedition consisted of nineteen members, nearly all of them being instructors or graduate students in zoology, or professional naturalists of recognized standing. Although numerous explorations have been made in West Indian waters during the past twenty-five years, very little work of the kind has been done at Barbados and Antigua, and the result of this expedition will add considerably to the knowledge of the geographical distribution of marine life.

The volume under review is written in a charming style, which will appeal to the general reader, just as much as the chapters devoted to scientific details will be of interest and value to scientists.

After discribing the preparatory arrangements which had to be made before starting, and after giving a pleasant account of the voyage from New York to Barbados, the author next describes the general life of the party at Pelican Island, Barbados, where quarters were placed at their disposal by the Government of the colony. Here Professor Nutting says that the party were extremely comfortable, and thoroughly enjoyed their stay.

In the two following chapters, notes on the zoology, entomology, and geology of Barbados are given. These are full of interest, although exception must be taken to the correctness of a statement made by some people in the island to Professor Nutting about the procedure of rats with coconuts; this is a popular myth now exploded, as is also the story told to the Professor in Dominica about the way in which the large Hercules beetle severs small branches of trees.

A chapter of general observations on the people and their customs, and on the scenery of Barbados, is written in an amusing style, and, considering the short time spent by the Professor in the island, his observations are shrewed and, in general, accurate; but residents in Barbados would probably like to know where to find 'guineas' as coins in circulation locally.

After about five weeks stay in Barbados the party proceeded to Antigua, where the Government placed at their disposal roomy buildings, formerly used as barracks, in the Dockyard at English Harbour, on the other side of the island from St. John's, the Capital. Here again Professor Nutting describes brightly the general life of the party in these quarters, where, as in Barbados, he states that there were very comfortable and greatly enjoyed their stay

The notes on the zoology of Antigua, which follow, are very interesting to any one whose tastes lie in that direction. The botanical notes are slight, but apparently accurate, as far as they go.

Concerning Antigua also Professor Nutting adds some general notes, recording amongst other matters rather amusing experiences of members of the party during their stay there. It is noticeable how the Professor managed in his short stay in both the islands visited to obtained so much reliable information with regard to them.

After about four weeks stay in Antigua the expedition left for New York, where, it is pleasant to note, they all arrived safely and in good health.

Professor Nutting and his party were greatly pleased at the profusion of marine life met with around the shores both of Barbados and Antigua. They were able to make many interesting and scientifically useful observations, and to collect a great number of sp cimens, many of them new to science, for future study, as well as for an important supply of material for use in the work of the biological classes in the Iowa University.

This volume will be found, apart from its scentific value, a very pleasant one to dip into by residents or visitors to these islands. Scientists, especially those devoted to marine zoology, will look forward with interest to the detai'ed reports on various groups of vertebrates and invertebrates inhabiting these waters, which the Professor promises will be issued by specialists who are to study the extensive collection of material brought back. Geologists will also look forward to the geological report to be issued by Pro. A. O Thomas, who was a member of the expedition.

The book is a record of a novel and interesting expedition, undertaken by an American University in search of more accurate knowledge especially of the marine zoology of the smaller British West Indies. The field is a vast one, only a fringe of which is explored; research in all directions, biological, physiological, geological, would amply repay further investigation at the hands of scientists in these islands. Why cannot the example of our American neighbours be followed by some of our British Universities? The American scientists have given an excellent lead, which might be followed to very gre at advantage by those more nearly concerned with these islands.

Utilizing Soil Potash by means of Intermediary Crops.—Pot experiments with loam and sandy loam soil, conducted at the New Jersey Experiment Stations, are reported to determine the utilization of soil potash by rape, field peas, barley, buckwheat, and soy beans. The soils were limed and fertilized, except with potash. It was found that the dry-weights of these crops grown without potash were essentially the same as when grown with potassium sulphate on both soils.

It appears that soy beans, and perhaps some other plants, have the habit of storing up an abnormal supply of potash where this is supplied in readily available form. Here, then, are crops that can use rather large amounts of the soil potash when forced to do so, but if permitted, will also use additional commercial potash for which apparently there is no return. Such plants should be more widely used to liberate the locked-up potash of the mineral particles of soils rich in potash. (*Experiment Station Record*, August 1,1930.)

A NOTE ON THE MOSAIC DISEASE OF SUGAR-CANE.

Considerable apprehension is at present being experienced throughout the West Indies at the rapidity with which the mosaic or mottling disease of the sugar-cane is spreading. In Trinidad, for instance, the Acting Director of Agriculture states that the disease has spread so rapidly in certain areas that it is practically impossible to eradicate plants fast enough to remove the infection. The most usual phase of this disease, the one occurring over thousands of acres in Porto Rico, as recorded in the *Journal of Agriculture* of the Department of Agriculture, Porto Rico, July 19, 1920, is that in which the leaves are marked with numerous very light yellow-green to nearly white spots, and with short stripes. The back ground will vary in colour from a normal green in plants but recently attacked, to a yellow green in more severe cases. The markings which produce the mottled effect are always much lighter in colour, making a very decided contrast. They are irregular in shape, varying from almost invisible points to irregular spots of an inch or so in their greatest dimension. For the most part they are linear, coalescing irregularly, and with indefinite margins. At times they constitute 50 to 60 per cent. or more of the total leaf surface. The midribs are to all external appearance normal. The leaf-sheaths present no abnormal signs, except a faint mottling in early stages of growth. As a general rule the leaves are uniformly mottled, but in cases where the disease first appears, examples are not uncommon in which only a portion of the leaf is affected. The lower leaves, anywhere from two to a dozen in number, will be in every appearance normal, then there will occur a leaf showing mottling for a few inches only at the base of the blade, which in turn will be succeeded by several others above, affected from half to two-thirds of their length. All above these trasitional leaves will be completely mottled. The appearance of the mottling, however, varies greatly with the variety infected.

Stevenson, of the Porto Rico Department of Agriculture, draws attention to some abnormalities which may be confused with mottling or mosaic disease. Deterioration may give rise to symptoms in the leaves, which may be readily confused with those of mosaic. In fact, the spots or discoloured areas can with certainty be distinguished only by their colour, which is of a decided yellow, rather than the white, or near white of the mosaic disease. They are not to be differentiated from the yellow spotting to be described immediately. Deterioration, Stevenson says, is widespread in Porto Rico, being especially common where unsuitable varieties are being grown, where cultivation and fertilization have been delayed in heavy soils, or during periods of drought. The fact that there is a recovery from this stage, that is the new leaves are normal, probably explains certain persistent claims that 'mosaic' has been cured by fertilization or other methods.

Another very common abnormality of cane leaves in Porto Rico is what has been designated as 'yellow spotting.' Certain varieties are very susceptible to it. It is characterized by small yellow spots with indefinite margins, very much resembling the markings of mosaic, except that the latter are nearly white, and are generally more linear. A further point of difference lies in the fact that this yellow spotting attacks the lower leaves first, new leaves issuing from the bud always of normal colour.

There is also a striping of cane leaves, which is particularly common in certain varieties. This consists of stripes of varying width, rarely including the better part of an entire leaf, and running the length of the blade.

In addition to the above abnormalities, which might be mistaken for the mosaic disease, there is the whitening or yellowing of the cane leaves known as chlorosis. The canes in which this occurs are commonly known in the West Indies as 'gall patch' or 'moonlight canes'. This trouble is found generally in small definite areas from a few feet to an acre or so in extent.

The mosaic disease, on the other hand, is spread by planting material from diseased canes, but secondary infection by means of aphides is of considerable importance. Thus Brandes finds that the sugar-cane mosaic virus is highly-infectious, but only under certain conditions, which are not as yet fully known. It is considered as proved, however, that cell sap of diseased plants is infectious when introduced into healthy individuals, and that aphides can play a part in the transmission. As in many other mosaic diseases, the infectious material does not seem to be highly specialized, but it may attack other plants of the same family. That this may in turn lead to the cane becoming infected from other members of the Gramineae will be obvious. Thus Mr. Williams, the Sugar-Cane Entomologist at Trinidad, states in his September report: 'Work on the attempted extermination of mosaic disease has continued. Every centre of infection in the Naparimas has been cleared two or three times, but fresh diseased stools are continually being found. The work of eradication in the St. Augustine district has proceeded, with one small exception, with unexpected smoothness, and the farmers have co-operated to help in the extermination. Progress is, however, slow, and many of the cleared areas are already reinfected. Mr. Roach has sent in corn and grass apparently infected with mosaic disease. Should it become at all general on native grasses, eradication will become impossible.'

Very recently Brandes has found a mosaic disease of corn, similar to that of sugar-cane. The manner in which corn mosaic is transmitted to healthy plants, and the relation of this disease to the mosaic of sugar-cane was demonstrated as follows.

Twelve corn plants were placed in each of two insect-proof cages. All plants were from the same lot of seed. About twelve individuals of *Aphis maydis* were carefully removed by means of a camel's hair brush, from sorghum plants affected with mosaic to each corn seedling in one of the cages. The sorghum plants had been infected by aphides from mosaic sugar-cane. Twelve aphides were transferred in the same way from healthy sorghum to each of the corn seedlings in the adjoining control cage. Less than a month later eight of the twelve seedlings in the first cage showed typical signs of mosaic, while the twelve control plants in the second cage remained perfectly healthy. Thus provision is made for almost unlimited dispersal of the virus of the disease through the medium of the corn aphis. There is no reason to suppose that transmission in nature is limited to this insect.

Control measures, Brandes says, must be based fundamentally on the removal of the sources of the inoculum. So far as is known, the only sources of inoculum are the living host plants. Destruction of these plants, then, will effectively eradicate the disease from any region. Practically, the destruction of all affected host plants presents almost insurmountable obstacles. The substitution of immune varieties of corn as well as of cane does not offer any immediate solution, since the most susceptible varieties happen to be the ones most esteemed. Elimination of this disease is dependent upon the planters understanding its seriousness. When this is accomplished, public sentiment will permit the passing of compulsory 'roguing' and quarantine laws, which will be necessary before any hope can be entertained of eliminating the disease.

CONTROL OF NEMATODES BY NEMATODES.

Nematodes may be, generally speaking, defined as a class of worms, mostly minute, several genera of which inhabit the soil, and by penetrating into the tissues of various plants, cause a considerable amount of damage to crops in many places. To take an instance in the West Indies, it may be remembered that Mr. W. Nowell, recently Mycologist on the staff of this Department, discovered that a species of nematode was the cause of the red ring disease of coco-nut trees, which has caused much loss to coco-nut growers in Grenada and Trinidad.

It has been discovered recently that there may be an effective means of controlling injurious nematodes by enlisting the services of one of the groups of the same class, which appears to feed on the injurious groups while not itself injuring plants. The nematodes belonging to this useful group are known as 'mononchs.' The method of employing them for the purpose of control of others is described by Dr. N. A. Cobb, of the United States Department of Agriculture, in *Science*, June 1920. This description is of interest in view of the damages caused by the injurious nematodes, and of the difficulty which has hitherto been experienced in their efficient control.

Mr. Cobb, who identified the nematode responsible for the red ring disease of coco-nuts, says that it is now beyond question that many soil-inhabiting mononchs feed m re particularly on other nematodes. However, they never follow these latter into plant roots, except in the case of open root cavities, fairly readily accessible. They do not enter living plant tissues in pursuit of their prey. It follows that the good they do is in devouring the larvæ and young of injurious nematodes at such times as the latter are accessible, either in the soil or in open cavities in the roots of plants.

In transferring mononchs from place to place, with a view to making use of them in combating injurious nematodes, the first requisite is a supply of mononchs. Such a supply may be obtained from soils in which the mononchs are numerous, and although there is comparatively little experience to serve as guide, yet it is now demonstrated that supplies of mononchs existing under these conditions are available. Thus far these supplies have been discovered more or less by accident; the cases, however, are numerous enough to establish the belief that special search will lead to the discovery of a sufficient number of these original sources of mononchs to furnish an adequate supply for trial.

The methods of collecting the mononchs, and transferring them, once they have been found, have been sufficiently elaborated for practical purposes, and published.

In transferring the mononchs to new situations, it is of course best to pay careful attention to the relative physical and biological conditions of the two habitats, the soil from which they are transferred and that to which they are transferred. The physical and biological conditions of the two habitats should be such as to insure the persistence of the mononchs after they have been transferred from the old to the new habitat. If the climatic and soil conditions of the new habitat closely resemble those of the old habitat, there is every reason to suppose that the mononchs will survive and flourish, if there is a supply of suitable food.

If it be asked why injurious nematodes are transferred from place to place without their enemies being transferred at the same time, the answer is that nematodes injurious to plants are often transferred in the interior parts of plants imported in a living condition, and, as already indicated, the mononchs and other predatory nematodes are less common in these situations than they are in the adjacent soil, which latter, in the course of commerce, is often removed from the roots, and not shipped. One need only instance the case of bulbs and similar importations to see how much better chance the injurious parasitic nematodes have of being imported than those which feed upon them have. There is also reason to believe that sometimes the parasitic nematodes infesting crops are more resistant to untoward conditions, e.g., dryness, than are the predaceous ones.

At the present time a stage has been arrived at when logically the next step is to try out the introduction of promising species of mononchs. Efforts of this kind will necessarily be somewhat expensive, probably more expensive than the corresponding early efforts to introduce beneficial insects. There can be no doubt, however, that the enormous losses due to plant-infesting nematodes fully justify the expenditure of even large sums of money in an effort to apply this remedy, more particularly because the remedy, when successful, bids fair to be permanent and self-sustaining.

After long-continued and intensive studies, Dr. Cobb expresses himself as thoroughly convinced that many of the practices evolved in the transfer of beneficial insects can, with appropriate modification, be applied to the nematodes. The greatest drawback in the case of the nematodes is the small number of people who are technically competent to make the necessary biological examinations. It is in this respect principally that their introduction will differ from that of the introduction of useful insects, in that the nematode problem is essentially a microscopic one. Though the collection of the nematodes from the soil differs entirely from the collection of beneficial insects, the methods have already been brought to such a state that there are no insuperable obstacles.

THE FLOWER AND THE BEE.

A book with the above title, by John H. Lovell, was reviewed briefly in *The Field*, September 25, 1920. It seems of general interest, although the reviewer considers that it is a book for bee keepers rather than gardeners. Flowers are discussed only in their relationship with the honey collectors. The importance of one to the other is much greater than is commonly supposed. Many fruit trees, for example, would be much less fruitful than they are, were it not for the agency of bees in the pollination of their flowers; and many most important flowers and vegetables are seed bearers through the ministration of bees, which as pollinators far surpass in importance all other insects. Unlike all other flower-visitors they collect pollen, and it is this habit which has gained them their pre-eminence in the floral world. Some bees visit only certain kinds of flowers, and they are known to fly miles in search of them. Insects other than bees which are known to visit flowers, such as butterflies, moths, flies, and beetles, are, however, thieves generally, and although they do often effect pollination, more harm than good is usually the result of their visits. Wind pollination is described as the oldest method of pollen dispersion, when gymnosperms were the dominating forms of vegetation. Insect pollination is said to be comparatively recent.

MARKET REPORTS.

London.—The West India Committee Circular. September 30.

Balata—Venezuelan Block, no quotations; West Indian Sheet, 4*s.* 7*d.* to. 4*s*7½*d.* c.i.f., spot and forward, 4*s.* to 4*s.* 3½*d.*
Beeswax—No quotations.
Cacao—Trinidad, 78*s.* to 38*s.* Grenada, 78*s.* to 80*s.*; St. Lucia, Dominica. and Jamaica, no quotations
Copra—£58. c.i.f, London, and £58 10*s.* c.i.f. Holland
Honey—62*s.* 6*d.* to 90*s.*
Lime Juice—Raw, no quotatons. Concentrated, no quotations.
Pimento—4*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T. S. Garraway & Co., October 25.

Arrowroot—$8·00 per 100 lb. duty paid.
Cacao—Lottings at $18·00
Coco-nuts—$70·00 for large, $36·00 for small husked nuts.
Hay—Sales at $6·00.
Onions—Lottings at $10·00.
Peas, Split—No quotations; Canada, $12·00 small, $12·50 large green.
Potatoes—New crop, sales at $13·50 per 160 lb.
Sugar—Market bare.

London.—The Perfumery and Essential Oil Record, September 21.

Bay Oil—30*s.* per lb. spot, and 28*s* forward.
Lime Oil—6*s.* for West Indian distilled, and for hand-pressed 26*s.* per lb.
Orange Oil—West Indian, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., October 6.

Cacao—Venezuelan, $18·50.
Trinidad, $17·25 to $17·75.
Coco-nut Oil—$1·95 per gallon.
Coffee—Venezuelan, 16c. to 17c. per lb.
Copra—9c. per lb.
Dhal—No quotations.
Onions—$8·75c. per 100 lb.
Peas, Split—$8·75 per 100 lb.
Potatoes—English. 8 to 10c. per lb
Rice—Yellow, $14·50. White, no quotations.
Sugar—No quotations.

New York.—Messrs. Huth, Gillespie & Co., Inc October 28.

Cacao—Caracas, 14c. to 14½c.; Grenada, 13½c. to 14c; Trinidad, 14c. to 14½c.; Jamaica, 8c. to 9c.
Coco-nuts—Jamaica selects, $48·00 per M; Trinidad $45·00 per M; Jamaica, $32·00; Trinidad $30·00 per M. culls.
Copra—7⅛c. to 7¾c.
Coffee—Jamaica, 10½c. to 13½c. per lb.
Ginger—28c. to 32c. per lb.
Goat Skins—Jamaica 65c, Antigua, Barbados, St. Thomas and St. Kitts 55c.
Grape Fruit—Jamaica, $3·00 to $5 00 per box.
Limes—No market.
Mace—28c. to 30c.
Nutmegs—16c.
Oranges—$3·00 to $3·50 per box.
Pimento—6½c.
Sugar—Centrifugals, 96°, 7½c.; Muscovados, 89°, 6½c. c. & f., Molasses, 89°, 6½c.

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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

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The Project in Agricultural Research.

A VERY able plea for a more deliberate planning of agricultural experiments is made in the September number of the *Experiment Station Record*. The project as a means of formulating and defining a scientific enquiry has come into quite general use in the Experiment Stations of the United States. According to the dictionary, a project is an undertaking—something projected, designed, or intended to be accomplished; a purpose, a plan, a course of action marked out to attain a definite end.

It would have been well if the project system had come into use in the early days of the experiment stations of the world, when there was need in so many cases of clear thinking in regard to the laying out and conduct of experimental inquiry, and when, with many inexperienced workers, it was important to know whither they were directed, and when they had actually arrived. Such a system might have enabled the checking of some rambling efforts, the purpose of and means of attaining which were vague. At all events, it would in some measure have avoided activities which turned out to be misdirected, and would have hastened the day of more deliberate planning.

Viewed from the standpoint of research, a project in agricultural inquiry is first of all a scientific undertaking. It aims to advance the science, and through this to advance the art of agriculture, and it is conducted in accordance with the methods of science. It is subject to the same critical tests and reviews that are applied to work in other branches of science. It implies accuracy, precision, and completeness as far as it goes. Its purpose is 'finding out and learning how'; hence it must be dominated by the spirit of inquiry. Instead of being satisfied with the purely empirical, it attempts to trace findings back to science or theory. It does not end with the gathering of observations and data. Experimental data and routine observations are means, and not themselves the end of agricultural research. Investigation has too often begun and ended with superficial facts and observations, the real meaning of which has neither been disclosed nor adequately sought.

A research project must be progressive in its conception and its conduct. It does not adhere to a stereotyped plan, but the method and plan will be progressive, although the ultimate object remains permanent. The subject of the project should be concerned with something which it is deemed feasible to ascertain, and not merely something that it might be desirable to know. Science proceeds on the basis that there is nothing which may not be known, but in specific cases the time may not be ripe for the problem to be attacked. The theme or subject, however, does not alone constitute a research project; it is the means to be employed, and the energy to be put into the effort that gives a project life and promise. It is easy to formulate topics for research—subjects on which it would be desirable to have more positive light, but it is less easy to define the method of attack, and the means which may be expected to afford this light. It is because the project is a definitely planned and conceived effort that the statement of it is of great importance. It is the starting point, and in a large measure it determines the general character and probable effectiveness of the work undertaken.

As a research project is purposeful, and is guided by a plan, it is diametrically opposed to the indiscriminate accumulation of data. In former years there was such a paucity of information as to what would follow a certain practice or continued course of action, that the somewhat routine gathering of data might give information, which was original for the time, and important in supplying a background for more specific plans. Many experiments of that type did not set out to test a theory or a hypothesis, but were devised mainly to see what would happen. This was especially true of a certain class of field experiments. The time was not ripe for soil studies as we now understand them, or for intimate inquiry into the relations of plant and environment. No one would wish to reflect upon the value for the time of these early efforts. Criticism is more properly directed at their frequent neglect as a source of suggestion for more specific inquiry, and at the continuance of undue emphasis on the accumulation of data according to a conventional plan.

Such an accumulation of data is often vigorously defended by citing the case of the Rothamsted experiments, laying chief emphasis on the long period over which they have been continued, and overlooking a distinctive feature that has characterized those experiments almost from the first. If those experiments had remained stereotyped, and if throughout their history they had not been marked by a type of inquiry which sought diligently the reason for the results and the relationships which they expressed, they would have been far less illustrious examples, and would have wielded a much smaller influence.

It is this spirit of inquiry accompanying these experiments through all the years of their continuance, and the advantage which has been taken of the opportunity afforded by them, that has made them what they are. This fact needs to be adequately recognized in laying stress on the importance of long-continued experiments. It is the great lesson from the Rothamsted work. The experimenter who sets out with no more definite plan than to see what will happen through a long course of years, needs to take care that the effort does not degenerate into the mere routine gathering and summation of the results. Unless the element of inquiry is early injected into the undertaking, and maintained, the work may actually represent a mere marking of time.

A project in research seeks an authoritative answer. Its purpose distinguishes it from routine effort. The mistaking of assembled facts and observations for the solution of a project may lead to the assumption that a discovery has been made, when in reality it has been overlooked.

FERTILIZER PRACTICE.

Assuming suitable conditions of light, temperature, humidity, and oxygen supply, the infertility of soils has in the past generally been ascribed to a deficiency in one or more of the essential elements. Of these, nitrogen, phosphorus, and potassium, have claimed the attention of the agriculturist almost to the exclusion of sulphur, magnesium, calcium, and iron. An entirely new view point, however, of the conditions which constitute fertility has more recently been put forward. The lack of physiological balance, excessive osmotic pressures, and the presence of toxic substances in the soil solution, though probably of equal, if not frequently, of greater importance in limiting crop production than the incapacity of the soil to supply nitrogen, phosphorus, and potassium to the roots, will be considered more conveniently in a separate note. It will be evident in any case that the rate at which individual elements are supplied by the soil (rate of solution and nitrification), and the whole question of antagonism are intimately associated. It is proposed here, however, merely to consider a single phase of the subject which has recently attracted considerable attention in the United States.

Professor Shull in *Science*, October 22, 1920, has very recently emphasized the relation of sulphur to plant nutrition, and has pointed out that much of the experimental field work of the past, dealing with the influence of fertilizer elements upon plants, has been so loosely done that it is necessary to re-examine the whole matter.

Although the value of sulphur, particularly in the form of gypsum, was recognized at an early period, the lack of uniform success with it soon led to its neglect as an important fertilizer. After the development of acid phosphate, the tendency was almost wholly toward soluble fertilizers containing nitrogen, phosphorus, and potassium. Sulphur was not included as a part of a 'complete' fertilizer, although it was recognized as necessary to plant growth. The soil was thought to contain enough sulphur, and plants were considered to need so little of it that it was added to the soil only incidentally, as in acid phosphate, or ammonium sulphate, along with the three elements forming the so called 'complete' fertilizer.

Experiment Station workers fell into loose ways of working with fertilizer salts. They have not hesitated to use sulphur-containing nitrogenous compounds when testing the influence of increased nitrogen on plant growth. Similarly the acid phosphate has been used in testing the effects of phosphorus; and potassium sulphate has been used when potassium was under observation. In comparing various forms of fertilizer elements, superphosphate for instance, has been pitted against bone meal, or potassium sulphate against potassium chloride, or ammonium sulphate against sodium nitrate, as a source of nitrogen. It is evident that such tests as these are all invalid, if sulphur itself is shown to be an important fertilizer element.

The basic facts brought out are briefly summarized here. In the first place, soil studies have shown that sulphur is one of the rare, necessary elements. Soils are generally no richer in sulphur than in the fertilizer elements, nitrogen, phosphorus, and potassium. This scarcity of sulphur in normal soils is probably related to the ready leaching of sulphur into drainage water. At the same time improved analytical methods have demonstrated that crop plants require more sulphur than was formally supposed. They remove it from the soil as rapidly as they remove any of the other elements which may become limiting factors. The normal sulphur content of soils is sufficient for from fifteen to seventy crops, provided there are no additions from outside sources as from rainfall. Even with the rainfall sulphur, it is probable that sulphur is just as often a limiting factor as is phosphorus, or nitrogen, or potassium. For two of the last named elements do not leach as readily as sulphur. The important point is this. If sulphur is a limiting factor, addition of any other fertilizer is useless, and a waste, just as much as would be the use of gypsum as a fertilizer if phosphorus were the limiting factor.

Instead of thinking of nitrogen, phosphorus, and potassium as representing a complete fertilizer, it is time that work was undertaken solely from the standpoint of limiting factors, including not only these three, but sulphur, calcium, magnesium, and any other factors which limit crop production.

The early failures with gypsum were probably due to the fact that phosphorus or some other element besides sulphur was limiting growth. Enough is known now to make fertilizer experiments crucial as to which element or elements limit production The only way to ascertain the facts is by actual tests The system of increasing soil fertility, in connexion with which a vast expenditure for fertilizers is recommended, should be examined and tested with open, unprejudiced minds. The tests of sulphur-containing fertilizers should also be examined and tested with open, unprejudiced minds. Tests of sulphur-containing fertilizers should be immediately initiated, for there are almost certainly many soils in which sulphur is deficient for optimum nutrition. In many cases where superphosphate has been used with success, it may be the sulphur rather than the phosphorus that is the valuable element. In such cases substitution of the cheaper gypsum might yield as satisfactory results as the more expensive fertilizer.

T. B. M.

EFFECT OF THE RELATIVE LENGTH OF DAY AND NIGHT ON GROWTH AND REPRODUCTION IN PLANTS.

Garner and Allard have carried out a very interesting and instructive investigation of the effect of different lengths of light exposure on the tendency of plants to become reproductive or to remain vegetative Several species of plants were used, and were submitted to varying daily lengths and intensities of exposure. The importance of light has of course long been recognized. Klebs, for instance, while working on the problem of rhythm, succeeded in making beech grow continuously in artificial light. Bonnier found that continuous illumination, as compared with alternate light and darkness, produced marked changes in the form and structure of the plant; the green colour was made much more intense, and the flowers were more highly coloured. Garner and Allard conclude that for each plant there is a critical length of daylight exposure essential to the development of the reproductive phase. The length of this critical exposure varies with each species and variety. By exposing plants to this critical length of illumination, the reproductive or flowering phase can be induced at almost any time. Experiment with shading indicated that time of exposure, and not light intensity is the primary factor involved in determining the critical day. Reducing the water supply diminished vegetative growth and fruit yield, but did not alter the time of fruiting in the least. The authors believe length of day, through its influence on fruiting and seed formation, to be a fundamental factor in plant distribution. They tentatively formulate the following principle: 'Sexual reproduction, can be attained by the plant only when it is exposed to a specifically favourable length of day (the requirements in this particular varying widely with the species and variety), and exposure to a length of day unfavourable to reproduction, but favourable to growth, tends to produce gigantism, or indefinite continuation of vegetative development, while exposure to a length of day, favourable alike to sexual reproduction, and to vegetative development, extends the period of sexual reproduction, and tends to induce the ever-bearing type of fruiting.'

The bearing of the experiments on plant distribution is evident. Much of the difficulty experienced with plants from northern latitudes, when grown in the tropics, is probably traceable to the relative lengths of the days in the north and in the tropics. The authors have not attempted to explain how length of day might determine the form of plant development. The balance between the carbohydrates and nitrogenous material is doubtless in a large measure responsible for the results obtained. Kraus and Kraybill, for instance, found that a relative abundance of carbohydrate over nitrogenous material in the plant induces fruitfulness, while a relatively greater nitrogen supply induces vegetative growth. The discovery by the authors of the influence of the relative length of day and night on growth and reproduction of plants opens up a most facinating field of research for the physiologist and ecologist.

T. G. M.

SUGAR GROWING ON TREES

In the *Louisiana Planter*, September 25, 1920, there is an interesting account of sugar which is naturally produced in lumps on the leaflets of a species of fir tree. From this article the following paragraphs are taken:—

Long before the first white man came to North America, the Indians of at least one district on this great continent had a white sugar of a very rare and high quality, a sugar derived from the strangest and an almost unbelievable source—from the foliage of the Douglas fir tree, growing in certain districts in the Province of British Columbia, Canada. Yet, remarkable as this botanical specimen is, the existence of sugar in such an unusual place as on the foliage of a coniferous tree seems to have entirely escaped the attention of all the white traders, explorers, surveyors, missionaries, and hunters who passed through the regions where it is found.

So, in spite of the fact that this sugar has been known to and used by the Indians for a great many years, it is only now that the interesting scientific facts of this phenomenon in the plant world are made available through the investigations and experiments of Prof. John Davidson, Botanist in charge at the University of British Columbia, Vancouver, who has recently made a careful study of the sugar exudations on the fir, and the conditions under which it is formed, by visiting some of the principal regions where these sugar-bearing trees grow.

The sugar appears in white masses of different sizes, ranging from $\frac{1}{4}$ inch to 2 inches in diameter. The smaller masses form like white drops at the tips of single leaves, and also at times several of the leaftips are imbedded in a larger drop. Masses of greater size are scattered over the leaves and branchlets. Placed in the mouth, the sugar is exceedingly sweet, having a flavour comparable to the highest class of the manufactured article. For a moment it passes into a pasty consistency in the mouth, but quickly becomes entirely soluble under the action of the saliva. It is quite hard and dry, and with no tendency to stickiness. A very light rain is sufficient to dissolve the sugar off the fir; but very often it recrystallizes on the ground.

The principal regions where Professor Davidson's investigations show the sugar to be produced are in the hottest and driest parts of the interior of British Columbia.

Professor Davidson was first inclined to think the sugar resulted from punctures made by insects, probably aphides. However, he found that only healthy Douglas firs yielded a sugar harvest, trees, practically free of any insect life. Thus the phenomenon was evidently the result of natural causes.

In the districts of the dry belt, on gentle slopes facing east and north, in comparatively open areas where the fir trees get plenty of exposure to sun, the sugar producing trees chiefly grow. Where the firs stand densely, or where the trees are on fully exposed southern and western slopes, the sugar is not generally found, as the ground in this latter area dries out very quickly. From this it is evident that soil moisture plays an important part in the sugar's production, when combined with certain requisites of sunlight. Where a great many leaves are exposed to the sun, as in the case of the firs standing on comparatively open areas on the slopes facing east and north, an abundant formation of carbohydrates occurs in a day. In the ordinary course of Nature's working, these carbohydrates would be carried to growing or to storage tissues, which is the case on Douglas firs in heavily forested areas. But throughout the dry-belt region the trees receive a much greater amount of unlight over a greater number of hours per day than in other localities where they grow. Here in the dry belt, the ground and atmosphere are also warmer, the air circulates more freely than in the coastal regions where the dense fir forests stand. Thus in the dry belt, where the firs are subjected to a long succession of unclouded days of blazing sunlight in summer, and where the soil condition provides warmth and moisture, the trees gather a great deal more carbohydrates than normally. The soil's increasing warmth over so great a period of sunlight permits the roots to maintain or increase activity, and to continue this nocturnally. This increased root-pressure and cessation of transpiration cause the leaves to become water gorged. This water contains a sugar created by the reconversion of starch into sugar. But the warm, dry atmosphere, existing even through the night in these dry-belt regions, quickly evaporates the water, and the sugar remains to form drops of syrup of various sizes deposited at the leaf-tips, some of which are so large that they fall on to branches and foliage below, resulting in irregular deposits.

The necessity for a succession of sunshiny days to produce the sugar, prevents a harvest that could annually be depended upon. Wet or cloudy days disarrange those atmospheric conditions which make the sugar possible. This the Indians knew, and in good years stored up as much of the delicacy as was obtainable.

Analysis of the sugar shows a high degree of constancy of composition, and, what is still more interesting, it contains a large percentage of an extremely rare variety of sugar. This particular variety is more abundant in the product of the Douglas fir than any other known plant. It was formerly obtained from a shrub, *Tamarix mannifera*, in Turkestan and Persia. Of this pure and rare trisaccharide, the sugar of Douglas fir contains almost 50 per cent. Thus, while the fir sugar will never play a part as a food supply, like the product of the cane and beet, it is likely eventually to prove valuable for use in chemistry, and perhaps in other ways.

ANOTHER SOURCE OF RUBBER.

In the *India Rubber World*, October 1, 1920, there is an account of the establishment of a company for the exploitation of a plant growing wild in the great arid region of Arizona and New Mexico, which appears to possess great possibilities.

The plant is known by the Mexican name of 'ocotillo', and is one of the candlewoods of the great arid region of the South-west, known botanically as *Fouquieria splendens*, and belonging to the Tamarix family, is a shrub with naked, wandlike, thorny branches, which, usually in February, after a brief rainy season, puts forth foliage and clusters of bright scarlet flowers. The stems have long been used as poles for wire fencing. The plant is usually about 10 feet tall. The supply is practically inexhaustible. Soon after it is chopped off close to the root it starts to sprout again. While lying in heaps in the yard, even three months after cutting, it often puts forth its flowers The Mexicans say that it has more lives than a cat, and that the only way to kill it is to burn it, root and branch. Officials of the company say that there is enough ocotillo within a 15-mile radius to keep their plant running at full capacity for fifty years.

The company's factory is equipped to take 100 tons a day of ocotillo, which is gathered by Mexican labourers, who get $6 a ton for the shrubs delivered at the mill. The entire plant, except a short root, is used. From the loading plat-

form the plants are hoisted to a chute, whence they are fed to a 'hog,' which grinds them into small chips. The chips are then put in a retort and decomposed by oil heat, and the volatile pyroligneous acid passes like steam through pipes to condensing vats underground, leaving the gums and tars in the closed vessel. The gums are separated from the tars with suitable solvents, and are sent to separate factories, while the liquor is shipped to a third factory. The Arizona plant makes no finished products.

One ton of ocotillo yields 306 lb of charcoal, 206 lb of tars, 130 gallons of pyroligneous liquor, and 173 lb of gums. The charcoal is said to be superi r to willow or poplar charcoal for sugar-refining, powder compounding, or absorbing emanations from radio-active water; the pyroligneous liquor is said to be rich in acetic and carbolic acids, as well as wood alcohol, a synthetic oil rivalling linseed, and other substances useful in the arts; the tars contain a high percentage of creosote, and have in the laboratories yielded 104 fractions, including most of the dyes, drugs, and synthetic preparations hitherto imported from Germany; but it is from the gums that there is extracted, after supplying material for lacquers, a substance said to equal first-class crude rubber, identical with it chemically, and capable of perfect compounding and vulcanization. This rubber content is 5 per cent. of the whole plant.

A material practically akin to hard rubber or ebonite, it is said, has been made from the residue of the tars, and has shown dielectric or insulating qualities equal to gutta percha. From this product the company intends to produce a compound for unbreakable talking-machine records.

The company is also experimenting with the species of cactus known as the 'saguaro' (*Cereus giganteus*), from which it is predicted a yield of 11 to 12 per cent. of rubber will be readily obtained. The saguaro, the largest of the cactus family, often, it is said, attaining a height of 60 feet, is an arborescent plant growing abundantly in Arizona and New Mexico, with sparse, candelabrum-like branches, bearing yellow flowers and edible fruit.

THE MANUFACTURE OF RUBBER PLASTERS.

The following information, concerning what must be regarded as a little-known industry, is abstracted from an article on the subject appearing in the *India Rubber World*, November 1, 1920. This should be of interest to those who may have to resort to the use of the medicinal plasters referred to.

It will doubtless surprise many to know that certain very important sections of the rubber industry have never been affected by the discovery of vulcanization. The lines here referred to are pharmaceutical preparations, known as adhesive plasters. The plaster business operates fully equipped factories, employs standard washers, mixers, calenders, and spreaders like any other rubber mill.

As in all lines of rubber work, the manufacture of plasters entails individual problems. Although thousands of tons of rubber have been employed, only the sweet smelling or non-odorous types are usable. Hence Pará, wild or plantation, is the favourite. In preparing the plaster compound, not only must it be non-odorous, but a peculiar degree of adhesiveness is demanded. It must be sticky, with the characteristic of remaining so and never drying out. Furthermore, the compound must contain drugs and medicaments in great variety, and in definitely ascertained proportions.

So far nothing is more permanently adhesive than melted rubber It is therefore not strange that in early plaster preparations it was used, and most successfully. So sticky is it that cloth covered with thin films, although exposed to the sun for months, does not dry out at all.

The 'lead plaster,' in which melted rubber is used, occupies an important place in the pharmacopœia of the leading nations. In the process of compounding it, the rubber is dissolved in a fixed solvent, such as petrolatum, and then mixed with lead acetate (prepared as lead oleate), and spread upon fabric.

What is known as 'French plaster,' consists simply of Pará rubber and essence of petroleum, with no medicament. This same compound serves as a base for mustard plasters, the mustard flour being dusted upon the surface of the plaster after it leaves the calender or spreader.

The preliminary operation in making 'porous plasters' is preparing the gums, resins, and waxes. These ingredients are melted by a steam bath, and strained for the purpose of removing all dirt and foreign matter. These are then mixed in a kettle with the medicinal agents required, and then incorporated with the sheet rubber on ordinary mixing mills. Each batch is made proportionately for 100-gross lots of the regular size porous plasters. The rubber compound is next calendered upon a sheet of fine cambric. This has been previously dried and, as it is free from size, the pressure of the rolls sets it firmly into the meshes of the cloth. As the sheet of coated fabric issues from the calender, the coated side is passed under an idler roller on to an octagonal handling reel, as it is necessary to keep the adhesive surface free from contacts. Separate individual maple dowels are used in winding upon the reel. The sheet is left upon the reel until the surface is thoroughly cool. When cool it is run through a strip cutter, and cut into strips usually 5 inches wide, each strip being wound on a separate spool. The spools, holding 100 yards, are passed next to the perforating machines. These machines are specially built, and are considered trade secrets. The ordinary plaster is 5 by $7\frac{1}{2}$ inches, and in this area are some 240 one eighth-inch perforations.

One machine handles about fifty plasters a minute, and in spite of the fact that the product is sticky beyond description, it runs smoothly and steadily day in and day out. Finishing consists in lightly pasting a square of backing cloth upon the reverse side of the plaster, and packing two dozen in a box for market.

Perhaps the neatest, if not the most valuable of all, is the 'surgeon's adhesive plaster.' The base is rubber—and good quality rubber. The only adulterant, or rather medicament, is zinc oxide. With the addition of a non-drying oil, this is the whole compound. This tape comes upon the market wound on spools of various sizes, so that almost any length or width can be found in the ordinary drug store. In manufacturing, the coated cloth is wound from the calender upon mandrels, and cut into short rolls on an automatic lathe. These rolls are then fed into a machine similar to a grommet setter, which forms a metal spool through and around the roll. It is then put in a tiny cartoon, and is ready for market.

In speaking of adhesive plasters it would not do to ignore those that bring comfort to the pedal extremities—'corn plasters' They are of ancient origin, and have attracted the inventive genius of such notables as Sir Humphry Davy and Sir Astley Cooper. To be sure, their formulas, salt of sorrel and potash, or yellow wax and verdigris, are no longer used, but they paved the way for the present sanitary effective rubber corn plaster.

ONIONS IN GRENADA.

The following paragraphs, as of general interest to the growers of onions in the West Indies, are reproduced from the Report on the Agricultural Department, Grenada, for the nine months, April-December 1919.

In 1918 it was demonstrated by the Department of Agriculture that onions could be successfully and profitably grown in the colony. The results recorded in the Annual Report for that year showed an indicated yield per acre of just over 2 tons of marketable produce, the seed being sown on November 6. During the present year, work in this direction has been continued, and interesting results have been obtained from trials with seeds sown on February 21 in beds, in the usual way. Before being sown the seeds were mixed with ashes which had been damped with kerosene as a precaution against ants, and in the drills they were covered with a mixture of sand and leaf soil As the seedlings were being grown in the dry season, it was necessary to water the beds several times weekly. By May 6, when showery weather began, a good stand of strong seedlings was available, a number of which were transplanted into a plot well prepared and manured, and made up into twelve beds. The land was manured with pen manure, approximately at the rate of 20 tons per acre. The crop grew well; it was weeded six times from planting to harvesting. Towards the end of July a large proportion of the bulbs showed signs of maturity, but as there were some indications of rotting, due to moisture and high temperature conditions, the tops of the bulbs that were still immature were bent over to hasten ripening. The crop was harvested on August 2.

The yield of onions was estimated at 10,300lb., or 4·6 tons per acre. The onions were cured in a well ventilated room for seventeen days, at the end of which time they were in a marketable condition; the loss in weight was equal to 26·51 per cent., giving an indicated yield of marketable onions per acre of 7,967·47lb. or 3·38 tons Calculated on this yield, with selling prices of 3c, 4c., and 6., the indicated return per acre would be as follows:—

7,969lb. at 3c.	£49	6*s.*	1½*d.*
" " " 4c.	£66	8*s.*	2*d.*
" " " 6c.	£99	12*s.*	3*d.*

The onions of this crop sold readily at 12c. per lb. locally. On the basis of the cost of growing onions at the Botanic Gardens, the calculated cost per acre, exclusive of the value of the manure used, would be as follows:—

	£	s.	d.
Draining and preparing land	12	5	9
Growing seeds		6	0
Four pounds seed at 4*s.*		16	0
Planting out seedlings	5	4	8
Watering	5	19	5
Weeding (six times)	7	7	2
Harvesting		17	5
Stringing	3	12	0
	£36	18	5

From this and the former trial with onions at the Botanic Gardens, it seems probable that two or more crops a year can be raised in Grenada. It is estimated, on the basis of the above yield, that the produce of about 20 acres would be annually required to supply sufficient for local consumption. It is not recommended that anyone should attempt to cultivate a large area of onions without first gaining practical experience; but the cultivation on a small scale by peasant gardeners would be a safe and profitable undertaking.

An account of experiments carried out by this Department to test the vitality of onion seeds when stored over calcium chloride, was published in the *Agricultural News*, Vol. XVIII, No. 459, page 375. From the results of that experiment it is evident that onion seeds can be stored over calcium chloride, and kept in a sound condition in the tropics for at least nine months.

THE FOREST RESERVES OF TRINIDAD AND TOBAGO.

In Trinidad and Tobago, as in other progressive parts of the world, forestry has been assigned a place as an important factor in the scheme of agriculture and industry. Council paper No. 25 of 1920 of the Government of Trinidad contains a short account by Mr C. S. Rogers, Conservator of Forests, of the present condition ofthe Forest Reserves, and outlines a scheme for their improvement. The forest policy of the Government, the report states, consists of the reservation of certain areas for:—

(1) The protection of the water-supply, the preservation of favourable climatic influences, and the maintenance of suitable breeding places for the bird and insect friends of agriculture.

(2) The production of timber and other forest products necessary for the welfare of the community.

The forests of Trinidad and Tobago are of the mixed evergreen type. They contain a large number of species, some of which are now marketable, but these, as a rule, form only a small proportion of the present crop. The cedar forests, for instance, contain only one marketable tree per 2 acres. It is proposed to introduce systematic management of the forests, whereby provision will be made for the replacement of trees that are removed, and the improvement of the forests by converting them into forests in which most of the trees will be useful to the community, instead of only 5 to 10 per cent., as is at present their condition. The forests of the colony are to be divided into four working circles, which will form the administrative units. Generally speaking the forests will be treated as 'high forests.' That is, the trees develop from seed, and are only cut when they have reached the desired size, a new crop being then again started from seed.

There is pressing need for attention to the question of the conservation of existing forest areas, and the reafforestation of denuded areas in all the smaller West Indian islands, as has been frequently pointed out in previous issues of this Journal. The report under review is full of excellent proposals with regard to these subjects, and is worth perusal by anyone interested in the subject. The advantages arising from scientific forest management are clearly and concisely put as follows: 'Reserves necessary for the supply of economic forest products should, as far as practicable, be situated on inferior soils which, though unfit for ordinary cultivations, are capable under proper management of yielding crops of timber and other forest products. On such poor lands the maintenance of timber-producing forests is a matter that requires systematic management on scientific lines, if the best results are to be obtained. Forests on inferior soils, if indiscriminately cut over, are liable to deteriorate into areas covered only by scrub and grass, and thus become subject to annual fires that would endanger the surrounding cultivations.'

The chief reason perhaps why afforestation does not appeal to the generality of people is the length of time before the crop can mature. Mr. Rogers considers that the age at which the principal timber trees of Trinidad reach naturity varies from sixty to 120 years. That forestry, however, is remunerative, when carried out on proper lines, is shown by the fact that during the five years 1910-14, the surplus sum credited to the Forestry Department in Trinidad was £14,000, which had increased at the end of 1919 to £28,428

There are appended to the report two excellent maps of Trinidad and Tobago respectively, showing the forest reserves, and the limits of the 'forest circles.'

GRENADA: REPORT ON THE AGRICULTURAL DEPARTMENT, FOR THE NINE MONTHS, APRIL—DECEMBER 1919.

Owing to the recent action of the Government of the colony, in making the fiscal year coincide with the calendar year, the report under review only covers the latter nine months of 1919. It still, however, shows evidence of what is so very valuable a feature in the work of Agricultural Departments, viz. continuity of effort, and continuous records of experiments undertaken and results obtained, even if these latter are of a negative character.

As is well known, cacao is by far the most important crop in Grenada, the value of the exports of this commodity for the year 1919 amounting to £539,740, out of a total of £623,017 for all exports from the colony. The report indicates that cacao cultivation is still being carefully attended to; in fact there seems to be a note of progress in the extended keeping of live stock on cacao estates, for the supply of farmyard manure to be applied to the orchards, and the more general use of mulches and green dressings around the cacao trees.

Spices, nutmegs, and mace, form the next most important agricultural industry of the island, accounting for £61,494 of the total value of exports for 1919. This crop was a record one both in quantity and value.

Cotton and cotton seed, both produced almost entirely in the dependency of Carriacou, form the next largest export, accounting for £14,752 of the total. It is hoped that the efforts of the Department towards producing an improved type of cotton plant in Carriacou, together with the Prize Holdings Competition for the encouragement of better systems of cultivation among the peasant growers, will still further advance this industry, the high prices obtained for the product in 1919 having stimulated interest in cotton growing.

Another industry which is chiefly pursued also in Carriacou, is the cultivation of lime trees Lime products to the value of £3,155 were exported in 1919, a serious decline from the value of those in 1918, which was £14,294. The diminution of interest in this industry is set down as probably due to the severe attacks of scale insects. Perhaps, too, it may be attributable to the charm of cotton cultivation for the small growers while cotton prices rule so high.

It is stated that large areas are still being planted with coco-nuts. Coco-nut plantations, started six or seven years ago, are now coming into bearing. That there is considerable interest being taken in this cultivation in the island is evidenced by the fact that in the nine months under review, 9,692 coco-nuts were imported by the Department, and distributed for planting purposes. It is unfortunate that the nematode disease of coco-nut palms, called 'red ring', is still causing trouble, but all available means for combating it are being used.

An interesting section of the report deals with experiments in onion cultivation in Grenada This will be found quoted on another page of this issue.

The Prize Holdings Competition for cotton in Carriacou was noted above. A similar scheme is worked in Grenada in the several parishes for ground provision crops. It is stated that peasant agriculture has much benefited by the stimulus afforded by the prizes offered in these competitions, so that ground provisions of every kind, as well as corn and beans, are being cultivated in general carefully and successfully.

Grenada has the name of a prosperous colony, and it is evident that the Department of Agriculture makes every effort to sustain and increase its prosperity.

VARIETIES OF THE COCO-NUT PALM.

The Bureau of Agriculture of the Philippine Islands has recently issued a revised edition of a bulletin on 'The Coco-nut Palm, its Culture and Uses,' by Dr. P. J. Wester. In this bulletin there are some interesting notes on varieties of the coco-nut palm found in the Philippines, and in the Federated Malay States.

It is stated that among the varieties that are found to a limited extent is what is known as the 'kapuno', the meat of which fills the cavity of the shell. Then there is the 'tamisan', the husk of which is sweet and edible. The 'niño' is a dwarf coco-nut tree which, it is stated, is well adapted for ornamental use in gardens and along roads. The 'bankalen' has a very thick husk, and would probably yield a large percentage of good coir. The 'manipod' is a very precocious variety, but with somewhat undersized nuts. Some varieties, like the niño, come into bearing when from three to four years old, but the varieties usually planted, and most esteemed for the production of copra, do not ordinarily arrive at bearing age until five or six years old.

Another variety which is of special interest, and which is noticed as grown in the Federated Malay States, though not apparently in the Philippines, is the 'dadch,' which contains detached granules of coco-nut meat in the milk, and is esteemed as a great delicacy when eaten with sugar. Another variety is the 'kuning,' the milk of which is very rich in sugar, and which is planted almost entirely for local consumption in the green state.

In selecting a variety for the production of copra, Dr. Wester points out that the one with the largest nuts is not necessarily the most desirable The point to be considered is the variety that produces the most copra. A variety bearing small but many nuts may thus be more profitable than one that bears large but few nuts. A precocious variety is considered to be preferable to one that is slow in coming into bearing.

Some of the varieties mentioned above may be worth while experimenting with in the West Indies.

EDITORIAL NOTICES.

HEAD OFFICE — BARBADOS.

Letters and matter for publication, as well as all specimens for naming, should be addressed to the Commissioner, Imperial Department of Agriculture, Barbados.

All applications for copies of the 'Agricultural News' and other Departmental publications, should be addressed to the Agents, and not to the Department.

The complete list of Agents will be found on the last page of this issue.

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NOTES AND COMMENTS.

Contents of present issue.

The editorial points out the advantages of clearly defined projects in carrying out scientific researches in agriculture.

Under Insect Notes, on page 378, will be found an article descriptive of the pink bollworm of cotton, which pest has lately made its appearance in the West Indies.

An article pointing out the desirability of furthur researches into the composition of artificial fertilizers, especially with regard to their sulphur content, appears on page 370.

The production of sugar on the leaves of the Douglas fir, which grows in British Columbia, is described in an article on page 372.

Some interesting varieties of coco-nuts are noticed on page 375

The Late John Reader Jackson, A.L.S.

We regret to record the death in England, on October 28, of Mr. J. R. Jackson, who, from the first year of the publication of the *Agricultural News* (1902), regularly contributed a monthly article on Drugs and Spices on the London Market. This he only discontinued, owing to increasing age and ill health, in June of the present year, as was noted in the issue of this Journal of July 10.

Mr. Jackson was born in London in 1837, and in 1858 he went to work in the Museum of the Royal Botanic Gardens, Kew, in which Department he remained until his retirement in 1901.

He was elected an Associate of the Linnean Society in 1868 and in 1883 he became an Associate of the Royal Botanical Society of London.

After his retirement from Kew he resided at Lympston, near Exeter, for the last nineteen years, and in the Churchyard there his body was laid to rest.

Mr. Jackson was the author of several books on botanical subjects, chiefly on the economic side of the science. For a number of years also he contributed articles to many scientific journals.

Insect Powders.

Many commercial powders used as insecticides are largely, if not entirely, compounded of the dried and powdered flowers of *Chrysanthemum cinerariaefolium*, commonly known as pyrethrum. From experiments recently recorded in a bulletin of the United States Department of Agriculture, noticed in the *Review of Applied Entomology*, September 1920 it is concluded that the insecticidal activity of pyrethrum is due to a mixture of acids and esters, which first benumb, and subsequently kill the insects brought into contact with it. While it is generally considered to be harmless to the higher forms of animal life, a number of cases are recorded where it has produced symptoms of a more or less serious nature.

The plant is cultivated commercially, and the powder made in Dalmatia, Japan, Australia, Algeria and California. The powder is sometimes adulterated with colouring matter, other species of flowers, or any convenient powder, but particularly with the dried and powdered stems of the pyrethrum plant itself.

In this connexion it is interesting to note that the flowers of a very common wild plant in the West Indies, *Parthenium hysterophorum*, belonging to the same natural order (Compositae) as the pyrethrum plant, and generally known in the English islands as 'White Head', is locally credited with the virtue of expelling fleas from a house. The flowering stalks are tied into broom-like bundles, which are used to sweep out flea-infested rooms. It is also locally supposed to keep away cockroaches from closed boxes or drawers, if the flower heads are freely sprinkled in them. It seems

quite possible that this local plant may possess kindred acids and esters in its flower heads to those existing in the flower heads of the pyrethrum plant.

Packing Seeds for Transport.

In the *Agricultural News*, October 30, there was a note on the packing of avocado seeds for transport over long distances. In connexion with this subject, directions given by Dr. Wester, Agricultural Adviser to the Government of the Philippines, in a revised edition of the *Bulletin* of the Department of Agriculture in those islands, will be found valuable. The bulletin is entitled 'Plant Propagation and Fruit Culture in the Tropics.'

Dr. Wester says that in the Temperate Zones practically all seeds may be shipped dry in ordinary paper or cloth bags, without impairing their germinability; but in the tropics the seeds of many species, such as the avocado, rubber, cacao, tea, and coffee, rapidly lose their viability if they are allowed to dry out. Therefore, such seeds should be carefully washed free of the pulp, spread out on the floor or on blotters in the shade, for from three to four hours to two or three days, depending upon the species and the character of the seeds, and on the moisture adhering to them, the seeds being exposed to drying until no longer wet.

The seeds should then be packed in a tin container, in charcoal, coco-nut fibre, peat dust, or sphagnum moss, to which just enough water has been added to make the packing medium feel a trifle moist, but not wet. The packing medium should not contain any excess moisture for absorption by the seeds, as in that case premature germination is induced, or, if very wet, the seeds decay. Experiments as to the degree of moisture to be supplied to the packing material in the West Indies would be of use.

Fair to good germination may be expected from seeds sown one to three months after being packed in this manner, and even longer, if the packing is properly attended to.

Banana Wine.

In the *Agricultural News*, November 15, 1919, a process for making 'banana cider,' as recommended from Saigon was described. That is, however, somewhat elaborate, and takes some time. The following is a translation of instructions as given in the *Bulletin de l'Association des Planteurs de Caoutchouc*, September 1920, for preparing an effervescent drink from bananas, much in the way in which a similar well-known drink is made from the sepals of the 'sorrel' (*Hibiscus Subdariffa*) in these West Indian islands. It appears to be worth experimenting with, especially as methods of giving it an agreeable odour are mentioned. The directions occur in one of a very witty and interesting series of articles, appearing in the journal referred to above, on the utilization of indigenous sources of food in West African colonies, written by Commandant Ch. Lemaire, Director of the Higher Colonial School at Anvers, who evidently has resided for some time in the French African colonies, and writes of his own experiences. The directions for making the drink, which the writer calls 'vin de bananes', are as follows:—

'Peel some thoroughly ripe bananas—the smaller varieties are the best for the purpose—and cut them crosswise into thin rounds. Fill an earthenware jar with one-third bananas and two-thirds water, leaving the contents to soak and ferment, watching the process of fermentation carefully, as it is very rapid, seldom lasting for more than twenty-four hours. Strain the liquor, which is then ready for drinking.'

The drink thus obtained is somewhat similar to an acid lemonade, slightly effervescent; an agreeable odour can be given it by the addition of some slices of lemon, or orange, or pine-apple, or a pinch of aromatic herbs. (Perhaps the like results would follow the addition of a few cloves, as is done with 'sorrel' in the West Indies.)

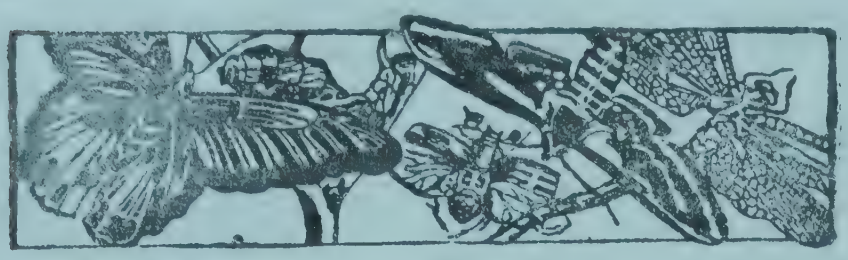
This banana wine ought to be druuk immediately; it cannot be kept for any time, except in bottles perfectly corked, and with the corks strongly tied down.

Agricultural Research in the United States.

The following notice, which is reproduced from *Science*, October 22, 1920, shows that the benefits derivable from co-ordinated work in agricultural research is thoroughly recognized in the United States.

'With the advice and the assistance of the National Research Council, a co-operating group of scientific investigators of insect pests and plant diseases, together with representatives of leading industrial concerns engaged in the manufacture of chemicals and appliances used in fighting these enemies of crops, has been organized under the name of the Crop Protection Institute. This institute will undertake and support a series of thorough scientific studies of the crop pests themselves, and of the means of improving and standardizing the materials and appliances used in fighting them.

'The annual losses because of the attacks on growing and stored crops by insect pests and plant diseases are enormous, despite all that has been done to lessen them. A conservative estimate of the loss of wheat in the United States in a single recent year, because of the black stem rust, is 18,000,000 bushels; and this pest is but one of the many that attack the wheat every year. What is needed is a combination and concentration of attack on these pests. The new Crop Production Institute will help to bring this about. It is not intended that the institute will interfere with or duplicate existing efforts now being made by Government bureaus, State experiment stations, and other agencies to fight crop pests, but that it will introduce a more general co-operation in the work, and give special attention to filling important gaps that now exist in it.'



INSECT NOTES.

THE PINK BOLLWORM OF COTTON.

In the last issue of the *Agricultural News* the Insect Notes dealt with the danger of invasion by pink bollworm in any cotton-growing country, and some of the means by which such invasions are and may be brought about were discussed.

Hardly had the Journal gone to press, when specimens were received from Montserrat, with the statement that these grubs, damaging the cotton bolls, had not been seen before in that island. Examination revealed the fact that this new pest is the pink bollworm— at least this is the opinion of the present writer, based on a study of the larvae and pupae, and of the nature of the injury to the attacked bolls. The moths have not yet been obtained in Montserrat.

The following notes are given, in order that anyone may easily recognize this pest.

The full-grown larva is about $\frac{3}{8}$ to $\frac{1}{2}$ inch in length. The whole dorsal surface is suffused with a rich, pinkish colouring. This colour first appears in the younger larvae in bands or patches which extend as the larva increases in age and size.

Fig. 15. Outline Drawing of Larva of Pink bollworm. Much enlarged. (Busck.)—(*U.S. Department of Agriculture.*)

The pupa is of a shiny yellowish-brown colour, about $\frac{1}{3}$ inch in length. The surface is pubescent, that is to say, covered with short, soft hairs. The moth is rarely to be seen, and the very minute eggs are scattered over the food-plants. The larva is an inside feeder. On hatching, the minute caterpillar bores into the boll and into a seed. A larva will usually eat out the contents of more than one seed, leaving the empty seed-coat, and boring its way into the next good seed. It sometimes bores neat round holes through the partitions between the locks in the bolls.

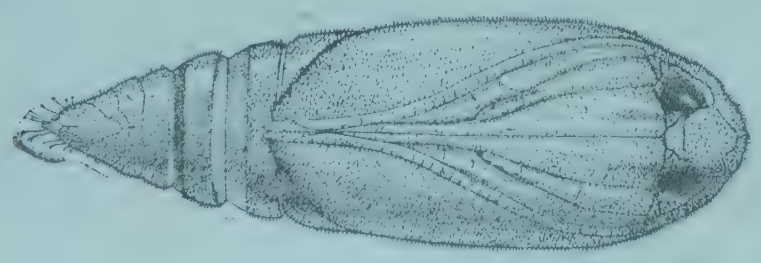


Fig 16. Pupa of Pink Bollworm. Much enlarged. (Busck.)—(*U.S. Department of Agriculture.*)

It is practically impossible to detect infestation in a young boll. Usually the first indication of an attacked boll is the exit hole made in the boll by the first larva which finishes feeding and then comes out to pupate. When those exit holes are found, it is certain that the infestation has been established for some weeks at least.

The egg stage lasts from four to twelve days; the larva stage occupies some twelve to fourteen days, the pupa stage about ten days. The whole life-cycle in the climate of the West Indies will probably be found to last from about a month to six weeks. The accompanying illustrations will serve to help in identifying this insect. If a caterpillar is found in green bolls, eating out the seeds, and if this larva is bright pink in colour; if it leaves the boll to pupate, by means of small exit holes, and if it bores very clean cut holes in the septum or division between the locks, it is likely to be the pink bollworm.

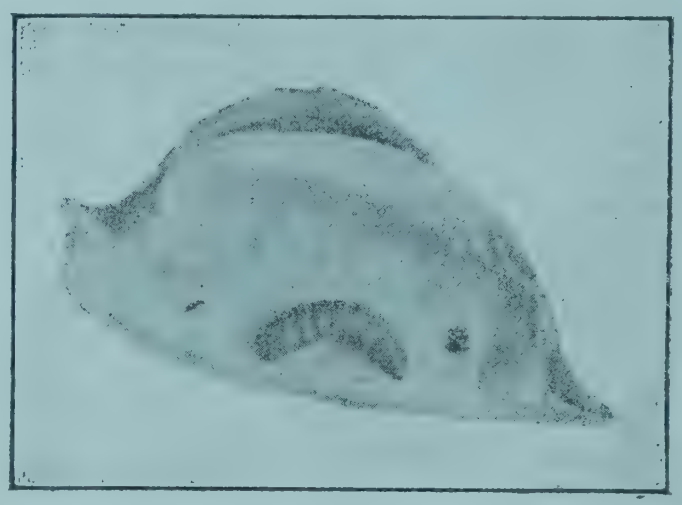


Fig. 17. Pink Bollworm Larva on Carpel of Cotton Boll, Showing also Typical Hole made by the Worm while Travelling from one Lock to the next. Somewhat enlarged.—(*U. S. Department of Agriculture.*)

The pupa is formed in the field among bits of rubbish on the ground: in the ginneries and storehouses it occurs in cracks, crevices, bags, on walls, etc. It is usually enclosed in a delicate cocoon of loosely woven silk.

At the end of the cotton season every cotton field should be thoroughly cleaned of all fallen bolls, dropped cotton seed, etc., and all cotton seed should be either crushed at once, or treated for the destruction of the insects in the seed.

Treatment of cotton seed by heating has been found to be effective and safe. The seed can be heated to a temperature sufficient to kill all the boll worms in it, without injuring the germinating power of the seed.

H.A.B.

DEPARTMENT NEWS.

Mr. H. A. Ballou, M.Sc., Entomologist on the staff of the Imperial Department of Agriculture, left Barbados by the S.S. 'Guiana' on November 17, on a visit to the Leeward Islands in connexion with matters relating to his office.

Instead of returning at once to Barbados from Dominica, Sir Francis Watts, K.C.M.G., Imperial Commissioner of Agriculture, is likely to proceed to St. Kitts on official business. It is probable that he will return to Barbados during the first week in December.

COMMERCIAL AND PROFESSIONAL ENTOMOLOGY.

In an interesting article entitled, 'Professional Entomology: The Call and the Answer,' which appeared in the *Journal of Economic Entomology*, August 1920 (Vol. 13, No. 4, page 355), the author, Mr. E. H. Gibson, Consulting Entomologist, Washington, D. C., discusses the prospects in professional entomology.

This article deals with opportunities for the consulting or contracting entomologist of practising his profession independently, on the same lines as doctors, lawyers, or engineers practise their professions. Economic entomology has been largely developed in the past, and entomologists mostly employed by national, state, or municipal organizations. It is suggested that now there are ample openings for private enterprise in this line of work. In support of this conclusion, reference is made to three specific instances. One of these is a farming corporation which produces and markets large crops of Southern agricultural products, and in so doing suffers severe losses from the action of insect pests. This corporation employed no entomologist either on the staff or in a consulting capacity, because, according to the author, there was none to be had.

Another business firm operates a series of granaries. Each year it meets with severe insect damage, because there has been no professional entomologist to plan and carry out fumigation operations.

In another instance, a city, in attempting to deal with the problem of garbage disposal, established a pig farm on the outskirts of the city. During the summer months the city swarmed with flies. If the services of a professional entomologist had been available, the flies could have been controlled, and the general sanitary conditions much improved.

The question is asked—Why do not concerns such as these consult the entomologists attached to government or state institutions? One answer is that such officials, not being business men, the advice given by them is thought not likely to be of the kind to appeal to business men. Another reason is that business men prefer to pay for services rendered, and they are suspicious of advice and help which is given free.

In another number of the *Journal of Economic Entomology*, that for April 1920, the news items under 'Current Notes' refer to four entomologists who have recently resigned government positions to enter into private or commercial work. They are:—one in Jamaica, who takes up a position with a sugar planters' association; one in the United States, who becomes entomologist for a railway company; another in the United States, who enters commercial work; and one in Canada, who goes to a chemical company.

Changes such as these are frequently referred to in entomological journals, and they indicate that it often happens that employment along such lines is more congenial or more remunerative than official service. Such employment is not, however, quite in line with the suggestion contained in the article referred to above. An example of this is the case of an entomologist of long service in government employment, who resigned to join a commercial enterprise as Biological Director.

This firm was established for consultation and contract work in minerals, metals, and their by-products. The biological department has for its object similar work in connexion with crop pests and sanitation work in which insect control plays an important part; it has recently announced that it is prepared to give courses of lectures in applied economic entomology, and correspondence courses in commercial and professional entomology.

It is argued that the training in entomology which is ordinarily given in colleges can usefully be supplemented by extra training at the hand of experienced entomologists, who are familiar with the requirements of applied entomology, particularly in connexion with problems such as those referred to earlier in these notes.

Instances are not wanting of successful endeavour in the past along the lines indicated, and it is reasonably to be expected that as the demand for such services becomes more manifest, entomologists of the right business outlook and technical experience will be available for the work to be done.

In all other branches of science applied to agriculture, as well as in entomology, development along these lines may be expected, and institutions in which training for this kind of work is given may well pay in the future more attention to the commercial and professional side.

YELLOW OR WHITE CORN.

In the West Indies there is a certain prejudice against corn meal prepared from white maize. This has been thought to be largely a matter of fancy, as it has been supposed that the white corn was of equal nutritive value to the yellow variety. It appears, however, that this whim or prejudice is shared by farmers in the Southern States of America, who consider that yellow corn is far more nutritious than white.

The *Louisiana Planter*, October 23, 1920, contains a note on this subject, in which attention is drawn to experiments conducted at the Wisconsin Experiment Station as to the comparative food value of the two varieties of corn. These experiments were made on rats. It was found that the rats, fed solely on white corn, died with unusual frequency, but that a change of diet from white to yellow corn gave satisfactory results. This led to a more careful experiment, when it was found that a rat, fed upon white corn only, developed the characteristic symptoms of the lack of the fat soluble vitamine. At the same time a rat, fed upon yellow corn only, remained in good health and vigour.

The conclusion is therefore reached, that yellow corn is really better food for stock than white corn, and probably also for human beings, so that the prejudice against meal derived from white corn is not without some foundation.

Dr. P. J. Wester, Agricultural Adviser to the Bureau of Agriculture of the Philippines, states that the belief that the coco-nut is dependent upon the salt air and breezes of the shore for its best development has no sound foundation, nor is there any reason to believe that the application of salt is in any way beneficial to the tree.

GLEANINGS.

One of the causes for corn going bad when stored for keeping is because it is put up hot from the sun. If one thrusts one's hand into a barrel of corn put up in this way, a considerable amount of heat will be felt Sometimes the corn becomes so hot as to crumble away. Care should always be taken, after drying the corn in the sun or in a drier, to let it cool thoroughly before storing it (*Journal of the Jamaica Agricultural Society*, August 1920.)

In the *Journal of the Jamaica Agricultural Society*, August 1920, it is stated that the most effective fly killer is formalin. Half a teaspoonful in a saucer full of water, coloured with milk or sweetened with sugar, will kill thousands of flies per day. Two or three such baits placed about the house are most effective. Although many flies may not be seen in the bait or flying close by, yet, if close attention is paid, many will befound on the floor; they may even fly outside, and then fall. The bait should be renewed every morning.

At Clairmonte, Jamaica, there is a fine tea plantation with a well equipped plant for preparing and packing the tea. The tea produced is of very fine quality. It commands good prices in England, and this experiment in tea growing has proved very profitable. It is believed that there are thousands of acres of land in the highlands of Jamaica as well suited for the production of tea as any land in Ceylon. (*Weekly Bulletin*, Department of Trade and Commerce, Canada, October 11, 1920.)

In the *Proceedings of the Agricultural Society, Trinidad and Tobago*, August-September 1910, it is stated that a sample of cotton, picked from the ordinary cotton plants which grow in the backyards all over the colony, had been forwarded for examination to Messrs. Wolstenholme and Holland, of Liverpool, who reported that it was very white, with a staple of 1¼ inches, very silky, and fairly strong, and that this cotton would compete with Egyptian of similar staple, and should be worth, when ginned, from 60*d.* to 62*d.* per lb.

Department Circular 128, of the United States Department of Agriculture, deals with the manufacture and use of peanut butter. The commercial production of peanut butter in the United States has in recent years developed to large proportions. One manufacturer alone produced about 6,000,000lb in 1919. There are dozens of large factories and hundreds of smaller ones. Peanut butter is probably the most important peanut product now manufactured in the United States. The peanuts used in making this butter in 1919 probably amounted to 6 or 8 million bushels, being at least five times the quantity used for this purpose in 1907 Peanut butter is a wholesome and highly nutritious food, having, it is stated, a much greater food value than beef steak.

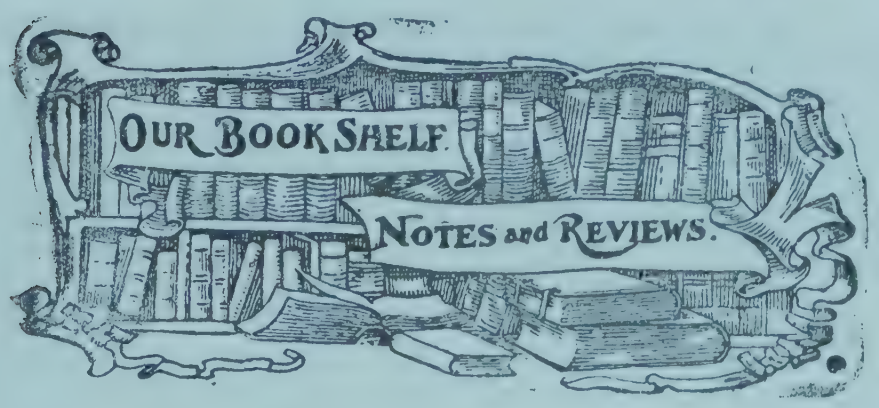
The *Louisiana Planter*, September 25, 1920, considers that in the manufacture of brown sugars the time will come when artificially drying them, in the same manner as is done in the manufacture of the finer and pure white sugars, will be a regular practice. Such brown sugar would sell at a price sufficient to justify a moderate outlay in artificial drying when this can be done, and the cost of the process would be negligible, while the gain in quality and the stability of the sugar as far as deterioration is concerned, would be well established.

In the Annual Report of the Director of Agriculture, Southern Rhodesia, for 1919, it is stated that there is a keen demand for such products as the colony is able to export The demand for Rhodesian tobacco, for instance, exceeds the supply, and there is every likelihood of a further expansion of this industry. Rhodesian tobacco, both the Virginian and Turkish types, seems now to have become well established in public favour, and is eagerly sought by the manufacturers, whilst the recently granted Imperial preference is likely to extend the market. (*The Board of Trade Journal*, September 23, 1919.)

The *Chamber of Commerce Journal*, October 8, 1920, in a note draws attention to the value of swampy tracts of land in New Zealand, under the peaty soil of which forests of kauri trees have been submerged for many centuries. From this peaty soil it is estimated that crude oil may be extracted to the amount of from 200,000 to 300,000 gallons per acre. The oil is by fractional distillation subdivided into a number of distillates, which in turn produce a variety of oils. This great natural asset of New Zealand is likely to be of immense value, in view of the present world shortage of petroleum.

Coco-nut oil is now shipped in bulk in tank steamers between the Philippines and San Francisco The oil is liquid at the port of shipment at a tropical temperature, but becomes solid at the port of destination in a temperate climate. This difficulty is met by fitting steam-heated coils in the tanks, the contents of which are thereby readily warmed to a temperature at which the oil becomes liquid when the time comes to discharge. To prevent the oil from solidifying in the pipe line through which it is pumped from the ship to the storage tank, a small steam tube is carried through the delivery pump. (*The Times* Trade Supplement, September 4 1920.)

In a study on commercial potato varieties by E. Baumann, data based on a number of individual selections vegetatively propagated from two varieties are presented. High yields are associated with an increase in number of tubers, but a decrease in size. The percentage of starch in the tubers is lower in high yielders, although the absolute amount of starch is greater. Data on the influence of various leaf diseases of potatoes in reducing yield are also discussed, and the author believes that the chief causes of 'running out' in potatoes are leaf diseases. (*Botanical Abstracts*, September 1920.)



THE MANUFACTURE OF SUGAR FROM THE CANE AND BEET, by T. H. P. Heriot, F.I.C., Lecturer on Sugar Technology at the Royal Technical College, Glasgow. *Longmans, Green and Co.*, London and New York, 24s. net.

This book appears opportunely, for great interest is now centred on sugar production, particularly with regard to the supply of sugar to the United Kingdom, where this commodity is still rationed. It has interest too, in that it deals with both cane and beet sugars; the increased production of cane sugar claiming much attention overseas, while the production of beet sugar in England is being pressed as a matter of national concern.

The book forms one of the series of monographs on Industrial Chemistry edited by Mr. Edward Thorpe. It is written in a comprehensive style, and is evidently intended for students who wish to acquire a sound knowledge of the principles of sugar manufacture, such as will enable them to mould their practice on sound scientific lines. The work observes the limitations imposed on the monographs of this series, that the books 'are not intended to cover the whole ground of the technology of the matters to which they relate. They are not concerned with the technical *minutiae* of manufacture except in so far as these may be necessary to elucidate some point of principle.'

Notwithstanding this, the present work will be welcomed and appreciated by those actually engaged in sugar manufacture, for it sets out general principles in a clear consistent manner, such as will enable those actually engaged in practical work to survey their methods in order to see how far they conform to the requirements of modern scientific progress.

The work is divided into ten parts, dealing respectively with :—

Raw materials,
Extraction of juice from the cane,
Extraction of sugar from the beet,
Composition of cane and beet juices,
Treatment of cane and beet juices,
Evaporation of water from the juice,
Crystallization,
Special methods of extracting sugar from molasses,
By products,
Refining of cane and beet sugars

In each of these subjects the principles involved in practical work are clearly set forth, and modern methods of working are described. Where, in view of the intended scope of the book, it is found inexpedient to attempt to go deeply into the technical *minutiae* of manufacture, reference is made to standard works, so that the student can extend his reading.

One would have welcomed more exact reference to the papers and publications of modern writers, so that the student might without difficulty refer to the original papers. For instance, when we are told (p. 349) that 'Geerligs has shown that the same weight of bagasse, derived from different varieties of cane, occupies different volumes, and this variation determines the weight of bagasse which can be burned per square foot of grate area in the furnace,' one would like to be able to turn up the original reference, for one feels that there may be other interesting details. Similarly, when on page 325 we read in connexion with crystallized sugar in molasses: 'it has generally been assumed that the percentage of crystals is too insignificant to influence the analytical figures, but this view has recently been disproved by Kalshoven, in Java, who devised a simple optical method of determining the percentage of crystals', one would like to know where these observations are recorded.

As already stated, the work covers the whole range of sugar manufacture; the information is given in an extremely lucid manner, and at important points tabular schemes are used for presenting the information in a forceful and useful way; while at many salient points the information is given in tables and summaries which are calculated to be of service alike to the student and to the pratical worker

It is impossible within the compass of a short review to attempt to deal with the contents of the several chapters, but it may be said that the information appears to be accurate and up to date.

While it may be invidious to select one portion of the work for comment, perhaps reference may be permitted to the information given with regard to the actual making or crystallizing of the sugar. The principles involved in the formation of the crystals of sugar in the vacuum pan are well and clearly stated—a most useful point for factory workers; while the several methods of boiling and handling the various grades of massecuite in order to produce the different types of sugar are carefully set out in a manner that students and workers in factories will appreciate.

While the book gives no information regarding the manner in which the actual chemical and physical methods of analysis are conducted, it being intended primarily for the information of sugar makers as distinguished from chemists, the use of chemical and physical data in the control of all stages of sugar production in the factory is fully dealt with at every stage, and examples given from factory practice; the aim being to show how efficiency is to be attained in each process, and how losses are to be avoided.

This text book is evidently intended, amongst other things, for the use of the writer's students in the Sugar School in the Glasgow Technical College: they should derive great benefit from the inculcation of principles so well set out. It may be hoped that the work will find similar use in connexion with the studies to be undertaken at no distant date in the West Indian Tropical Agricultural College. Beyond this, the work may be commended as of value to those engaged in the actual duty of sugar-making, and from this point of view, it is sure to have a wide range of readers.

In *Botanical Abstracts*, September 1920, there is a short note on the derivation of the name 'Fleur de Lis' with the old English equivalent 'Flower de Luce,' as applied to the Iris. It appears to have been first applied to the yellow iris growing wild on the shores of the River Lys in Flanders. When the Franks left Flanders in the middle of the fifth century to conquer Gaul and to established the Kingdom of France, in commemoration of their birth-place they selected this flower for their emblem. The name 'Fleur de Lis' is therefore only an abreviation of 'Fleur de la Lys.'

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

GRENADA. Plant distribution during the month of October comprised 664 coco-nut plants, 100 cacao, 21 grafted mango plants, 122 ornamental, 82 onion, and 24 other economic plants. Regarding staple crops, the Superintendent of Agriculture, Mr. R. O. Williams, states that fairly large pickings of cacao are now being made. The corn crop is in full swing and has proved to be a heavy one. A wilting disease of yams, accompanied by scale insects on the tubers, has been observed in certain districts. Thrips has been more prevalent during the month, but in most cases, especially on large estates, measures have been taken to cope with it. Proposals to establish a corn drier and granary have been approved, and a drier of the Chula ND type has been ordered, and the reconstruction of the cotton ginnery buildings commenced. The rainfall recorded at Richmond Hill during the month was 12·98 inches.

ST. VINCENT. During the month of October plant distribution included 13 grafted mango plants, and 1,500 sweet potato cuttings. Cotton picking, Mr. Jackson states, is becoming general, and fair returns per acre are expected. Exact figures as regards the area under cotton have not yet been obtained. That under estate cotton is 3,543 acres, as against 2,934 for last year. Soft rot of bolls has been reported, but the infestation is said not to be as serious as it was at a similar time last season. Ground provisions and fruit are still plentiful. At the ginnery 46,774 lb. of cob, and 37,676 lb shelled corn were purchased, and 118,270 lb kiln-dried. The rainfall recorded at the Botanic Station for the month was 21·56 inches; for the year to date, 86·92 inches. At the Experiment Station 15·06 inches was the record for the month.

ST. LUCIA. During the month of October the following plants were distributed from the Botanic Station: ornamental 93, grafted mangoes 11, nutmegs 7, cuttings 30, and 3 packets of flower seeds. Work in the Experiment and Botanic Stations was of a general routine character. Referring to staple crops, the Acting Agricultural Superintendent, Mr. E. Buckmire, states that with the liberal rainfall throughout the month good growth has been made by the sugar cane crop, and supplies have been well established. Cleaning out and deepening silted drains had to be attended to. The crop, on the whole, is very promising. The lime crop has slackened somewhat. The price for concentrated lime juice in the London market has dropped from £47 to £30 per pipe, in consequence of which the local prices for lime fruits and juice have been reduced. The cacao crop is advancing satisfactorily, and small pickings continue. With the heavy weather pod diseases appear everywhere; destruction of the pods by rats is severe, and with the fall in prices it is feared that this product will be neglected by the peasantry. Foodstuffs were plentiful during the month; this was a great relief to all concerned. The service of the crossed Berkshire boar at Réunion has been much in demand. The prizes in the recent Prize Holdings Competition were awarded as follows: Castries 3 coco-nut prizes, value £4 10*s.*; Castries 4 cacao prizes, value £11, 4 lime prizes, value £6 10*s.*; Soufrière 4 cacao prizes, value £14 10*s.*, Dennery 3 cacao prizes, value £7, 2 lime prizes £5; Micoud 4 cacao prizes, value £11, and 4 lime prizes, value £6 10*s.* The total rainfall recorded at the Botanic Gardens, Castries, for the month was 14·11 inches; at the Agricultural and Botanic Station, Choiseul, 12·61 inches.

DOMINICA. In addition to cultural operations, work in the Botanic and Experiment Stations during the month of October included, removing landslides, cleaning drains, repairing roads, and making good the damage caused by heavy rains. Plant distribution included 3,550 lime plants, 50 vanilla, 60 budded citrus, 17 grafted mango plants, 20 mangosteen plants, and 2 miscellaneous. In addition, there were sold 800 sugar-cane cuttings, 300 shade tree cuttings, 35lb. horse beans, 210 packets vegetable seeds. As regards staple crops, Mr. Jones, the Curator, records a furthur decline in the local rates for lime products, the price of ripe lines having fallen from 5*s.* 6*d.* to 4*s.* 6*d.* per barrel, and raw lime juice from 8*d.* to 6½*d.* per gallon. The London and New York markets for concentrated lime juice are reported to be greatly depressed. The cacao crop is very late, and prospects appear to be below the average. Mr. F. Hardy, Chemist on the Staff of the Imperial Department of Agriculture, arrived at Dominica on October 29, for the purpose of undertaking chemical investigations, principally in connexion with soil problems. The rainfall recorded for the month was 12·60 inches. Of this amount 1·88 inches were recorded between October 1 and 15; the remainder fell between October 16 and 31.

MONTSERRAT. Mr. W. Robson, Curator, in items of interest during to the month of Ootober, says that the weather, on the whole, was favourable for crops. The second growth of cotton on the breeding plot in the Experiment Station became badly infested with mildew and rust, and ripened prematurely. Nevertheless, a fairly good second crop was obtained. Plant distribution comprised 800 bay plants, 400 lime plants, 5lb. sword beans, 31 packets various beans, and 20 packets English vegetables. The still at the Botanic Station having broken down, no distillations of bay leaves were made during the month. Further experience with the Para pea shows it to be a useful addition to the list of vegetabies. The very large silk-cotton tree in the Experiment Station has been destroyed. During the latter part of the month there was two much rain to allow of the picking of the second crop of cotton; but except in damp localities, losses through diseases encouraged by humidity have not been excessive. Cotton planted after June does not promise todo well, notwithstanding the favourable weather. Persistent attacks of cotton worm have been experienced in some localities, and the general prevalence of leaf-blister mite is commented on. Somewhat discouraging rumours are said to be current concerning the prospects of Sea Island cotton lint on the English market in the present season. As was to be expected in view of the prolonged drought early in the year, the prospects for the lime crop are not at all good. Considerable trouble is being experienced from attacks of worms on growing maize. Samples of lint of thirteen strains of cotton have been sent to the British Cotton Growing Association for report and valuation. The rainfall recorded at Grove Station during the month was 4·88 inches. The total rainfall for the year to date is 40·26 inches.

ANTIGUA. The plant distribution for October included: 5lb Algoroba seeds, 47lb black-eye peas, 40lb Guinea corn, 40lb sweet potato sets, and 1 budded orange. In addition, 241¼lb selected cotton seed were sold, making the total sold to date 4,679½lb. Mr. F. G. Harcourt, Agricultural Superintendent, states that the sugar-cane crop shows some improvement under the influence of continued showers of rain which fell during the month, but in very

few districts has the formation of cane been yet observed. The cotton crop has also improved. In some districts the picking of cotton has already begun, while in others the planting has only just been concluded. Slight attacks of the cotton worm were noticed in one or two districts in the south of the island. Paris green for their control was obtained from the emergency stock at the Botanic Station. The presence of cotton stainers and leaf-blister mite was also noticed. The cotton boll worm has also made its appearance at Skerretts Experiment Station. Another allotment of 1 acre in area was sold under the Land Settlement Scheme at Sawcolts. The campaign against termites, with arsenic, was continued during the month. The rainfall for the month was 3·67 inches; total for the year to date, 24·17 inches.

From a brief report on Agricultural Instruction accompanying the foregoing, it appears that twenty-three peasant holdings in the Piccadilly district were visited during the month by the acting Land Officer. The reaping of the Indian corn crop in this district was concluded, the total quantity reaped being 22,000 lb., the majority of which was sold to neighbouring estates at the rate of from 16*s.* to 20*s.* per 100 lb., the remainder being kept for replanting purposes, and grinding for local consumption. Lands are being prepared, and the replanting of this crop is in full swing. The cotton crop in the district is promising, but a small infestation of cotton stainer was observed, also slight attacks of leaf-blister mite. Sawcolts Land Settlement was also visited. Here the reaping of the Indian corn had commenced, corn on the cob being sold to Bendals and other neighbouring estates at the rate of 20*s.* per cwt. Lands are also being cultivated for replanting. In both districts the reaping of the sweet potato crop had commenced.

ST. KITTS. Routine work was carried on in the Botanic Station during the month of October, and 500 sweet potato cuttings were distributed. The first half of the month, Mr. Shepherd states, was dry, and affected the growth of the cane crop; but during the latter half there were good rains, and conditions have much improved. The crop is green but very backward for the time of year, and constant rain will be needed to obtain even a moderate return. Where well manured with farmyard manure, or where artificial manures have been applied, the canes are responding to the good weather conditions. The picking of cotton is now in full swing, and a good deal has already been ginned. No price has as yet been offered locally either for seed or lint cotton. The returns in the valley district promise to be up to the average. The cotton worm has been vere troublesome during the last few weeks, and constant dusting of the plants with poison has been required. At a meeting of the Agricultural and Commercial Society held on October 2, a Resolution was passed in favour of direct steam communication between the United Kingdom and the West Indies. The rainfall for the month was 4·52 inches; for the year to date, 30·20 inches.

NEVIS. It is gathered from notes forwarded to the Head Office by the Agricultural Instructor, Mr. W. I. Howell, that all crops in the Experiment Station made good progress during the month of October. There were distributed from the Station during the month, 2½ lb Tonkin peas; there were also sent out 1,478 lb Paris green, and 1,316 lb lime. The sugar-cane crop has made good progress, although still backward. The cotton crop throughout the island has also made good progress; the plants are all of a good type, and are bearing well, and should favourable weather prevail, this is expected to be the largest crop reaped for some years. It was attacked by the cotton worm during the month, but only in a few places was there any damage done. The cotton stainer also made its appearance on one estate. Frequent rains have caused boll-dropping in many places, especially in the older fields. The picking of cotton has begun in many places, and good yields are being obtained. Provision crops throughout the island are doing well. The rainfall for the month was 6·76 inches; for the year to date, 30·47 inches.

BRITISH VIRGIN ISLANDS. The following represented plant distribution at the Botanic Station, Tortola, during the month of October: 344 coco-nut plants, and 76 decorative plants. Regarding staple crops, Mr. C. A. Gomez, the Curator, states that the cotton fields made considerable growth under the influence of the heavy rains received, which, however, seriously hampered the reaping of the cotton. The crop promises to be a successful one. Leaf-blister mite is said to be on the increase. The rainfall for the month was 8·10 inches.

AGRICULTURE IN BARBADOS.

October closed with a total average rainfall for the month of 6 inches. On November 1, there was a general fall which exceeded ½ inch. The amount registered so far, for the month, in the black soil districts is ¾ inch, and in the red soil districts 1¾ inches. In the former it appears that the rainfall for the year is only 29½ inches, while in the latter the total rainfall for the year, up to the present is 44½ inches.

The recent rains have been especially beneficial to vegetable crops and to some fields of cane which are doing well, but in the black soils some fields of ratoons will hardly develop any more.

The attention of planters is directed to the suspected appearance of the mosaic disease in the island. Careful cultivation of the soil, proper preparation, and drainage, use of organic manures and lime, and a proper system of rotation will keep canefields in a position capable of resisting this and other diseases.

The planting of the young crop will soon be general, and it seems that the B.H.10 (12) will be the favourite seedling.

In making up farmyard manure, the best material available should always be used. Manure made up of only trash and mould can never have the same beneficial effect on soils as that composed of bush and grasses.

The yam crop will not be as plentiful as at first expected. Some fields are gradually dying out. The potatoes recently planted are growing well, and quickly covering the ground. It is hoped that the supply of them will be good, as they form one of the principal local foodcrops. (The Barbados *Agricultural Reporter*, November 13, 1920)

A denatured alcohol plant is to be established at Hawi plantation on the island of Hawaii, which will be similar to the one at Paia on the island of Maui, which has proved so successful. The product of the new plant will be used as a gasolene substitute for the operation of tractors, automobiles, and trucks. It is estimated that 300 gallons will be produced daily, at a cost of not more than 20c a gallon. (The *Louisiana Planter*, September 25, 1920.)

MARKET REPORTS.

London.—The West India Committee Circular, October 28.

Balata—Venezuelan Block, no quotations; West Indian Sheet, 4*s.* 2*d.* to. 4*s.* 3*d.* c.i.f., spot 4*s.* 7*d.*
Beeswax—No quotations.
Cacao—Trinidad, 78*s.* to 80*s.* Grenada, St. Lucia, and Jamaica, 72*s.* Dominica. no quotations.
Copra—£57. London, and £58 10*s.* c.i.f. Holland.
Honey—62*s.* 6*d* to 90*s.*
Lime Juice—Raw, no quotatons. Concentrated, no quotations.
Pimento—4*d.*
Rubber—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T. S. Garraway & Co., November 24

Arrowroot—$8·00 per 100 lb. duty paid.
Cacao—Lottings at $18·00
Coco-nuts—$70·00 for large, $36·00 for small husked nuts.
Hay—Sales at $6·00.
Onions—Lottings at $7·50.
Peas, Split—No quotations; Canada, $12·00 small.
Potatoes—New crop, sales at $18·11 per 160 lb.
Sugar—$10·00 per 100 lb.

London.—The Perfumery and Essential Oil Record October 22.

Bay Oil—26*s.* per lb. spot.
Lime Oil—5*s.* for West Indian distilled, and for hand-pressed 23*s.* per lb.
Orange Oil—West Indian, no quotations.

Trinidad.—Messrs. Gordon, Grant & Co., October 6.

Cacao—Venezuelan. $18·50.
Trinidad, $17·25 to $17·75.
Coco-nut Oil—$1·95 per gallon.
Coffee—Venezuelan, 16c. to 17c. per lb.
Copra—9c. per lb.
Dhal—No quotations.
Onions—$8·75c. per 100 lb.
Peas, Split—$8 75 per 100 lb.
Potatoes—English 8 to 10c. per lb.
Rice—Yellow, $14·50. White, no quotations.
Sugar—No quotations.

New York.—Messrs. Huth, Gillespie & Co., Inc October 28.

Cacao—Caracas, 14c. to 14½c.; Grenada, 13½c. to 14c; Trinidad, 14c. to 14½c.; Jamaica, 8c. to 9c.
Coco-nuts—Jamaica selects, $48·00 per M; Trinidad $45·00 per M; Jamaica, $32·00; Trinidad $30·00 per M. culls.
Copra—7⅛c. to 7¾c.
Coffee—Jamaica, 10½c. to 13½c. per lb.
Ginger—28c. to 32c. per lb.
Goat Skins—Jamaica 65c. Antigua, Barbados, St. Thomas and St. Kitts 55c.
Grape Fruit—Jamaica, $3·00 to $5·00 per box.
Limes—No market.
Mace—28c. to 30c.
Nutmegs—16c.
Oranges—$3·00 to $3·50 per box.
Pimento—6½c.
Sugar—Centrifugals, 96°, 7½c.; Muscovados, 89°, 6½c. c. & f., Molasses, 89°, 6½c.

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AGRICULTURAL NEWS.

A FORTNIGHTLY REVIEW

OF THE

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The Sugar Outlook.

IN the *Agricultural News*, May 29, 1920, the editorial referred to the abnormally high price of sugar, especially in the markets of the United States. The opinion was then expressed that such prices could not continue for very long, but that, nevertheless, sugar would probably settle down to a price above its pre-war figure, which would still prove sufficiently remunerative to the producers.

The condition of the sugar market in the last three months has justified the correctness of the first part of the judgement expressed. As is well known, raw sugars, which were quoted in New York on May 22 at 24·67 cents per lb., fell to 7·76 cents per lb. on October 9. Since then there has been a slight improvement in the market, which now seems to be steadying.

The abruptness both of the rise and the decline in price is a remarkable feature. As *Facts About Sugar*, October 23, 1920, says, the only previous occasion on which prices have advanced with equal rapidity was in August 1914, at the outbreak of the European war. In that case, however, the increase did not carry nearly so far, and the subsequent decline was very gradual and spread over a long period. It is noteworthy that the decline has been much more protracted than the advance, extending over a period of twenty weeks as compared with twelve weeks during which prices were rising.

Naturally this extraordinary fall in price has attracted much attention in sugar journals, and has caused considerable apprehension in the minds of sugar growers and manufacturers. Still the situation need not be viewed from an unduly pessimistic position, as was pointed out in an article which appeared in the previous issue of *Facts About Sugar*, October 16, 1920, from which much is reproduced below.

It is true that the swift descent of sugar prices from the abnormal heights which they

attained last spring has inflicted serious losses upon merchants and manufacturers pursuing the legitimate course of trade. It has also affected producers who paid for their cane on the basis of 20-cent sugar, and now can obtain only about a third of that sum for their product. Still the fact must not be lost sight of, that there is underlying strength in the position of sugar.

By the foregoing remark it is not meant to imply that present conditions are normal, or that prevailing prices accurately reflect the actual position of sugar. The movement of prices is like that of a pendulum. If its upward swing is carried too high, the downward return will go too great a distance in the opposite direction, and only gradually does it regain the normal arc of its oscillations.

The recent price bubble is not without its valuable lessons. It has demonstrated that abnormally high prices may be of little benefit to producers in the long run.

Another truth that has been forcibly illustrated is the close relationship between market prices and demand. It was freely predicted of sugar, as well as of other commodities, that high prices would not hamper consumption, because of general prosperity. For a time it seemed that there was some truth in this assertion. More recently the acute falling off in demand has demonstrated that beyond a certain point consumption decreases progressively with each advance in price. This applies not only to individuals, but also to nations. During the period when prices in the American market reached their highest, many countries in which a genuine shortage exists shipped sugar to the United States, believing that at the prices offered they could use the proceeds of such sales to better advantage than they could the commodity itself. Thus the prevalence of abnormally high prices cut down consumption, not only in the United States, but also in every other part of the world, and so converted a general shortage into a temporary plethora of sugar. The only efficient corrective of such a condition is the reduction of prices to a point that will restore this arrested demand, as it undoubtedly is being recreated at the present time, though the effect may not yet be fully evident.

It is a curious, though perfectly human phenomenon, that when the price of any commodity is rapidly rising, the average member of the industry concerned can see no limit to its upward progress, and, conversely, when prices are falling, he acts as though convinced that the decline was bottomless. Acting upon the knowledge of the trait, the successful trader in commodities makes it his rule to sell when all the world is anxious to buy, and to buy when the crowd is directing all its efforts toward selling.

Applying this time-tested principle, it is obvious that the present is a time when the wise producer is expanding his facilities, and planning to increase his output. He is not disturbed by predictions of two-cent raw sugar or a four-cent basis for refined, which are as much beside the mark now as were the confident expectations of a forty or fifty-cent price, which were voiced in some quarters a few months ago The position of sugar has not been permanently impaired by recent developments. To the extent that the world's industrial outlook is less favourable than it was six months ago, sugar production must suffer in common with other forms of productive enterprise. But it must be remembered that sugar is an essential food, a necessity to modern civilized peoples. The world shortage of sugar still persists, and it is reasonably certain that the world will be able to absorb all the sugar that can be grown and manufactured for the next several seasons, at a price that will yield a reasonable profit to enterprises conducted on an economically sound, and not inflated basis.

In conclusion, with regard to the situation as it affects West Indian sugar planters and manufacturers, and with regard to the future outlook, the following calculation, taken from the *Weekly Bulletin* of the Department of Trade and Commerce, Canada, October 18, 1920, seems to be distinctly encouraging.

A substantial proportion of the British West Indian sugar crop of 1920 was sold to England at £38 10*s.* per ton, f.o.b. Converting the pound sterling at the rate of $4·80, this equals roughly 8·2 cents per lb. in the West Indies. With the discount on British West Indian funds in New York, the crop price would hardly average more than 6½ United States cents per lb. That price for sugar has given the British West Indies a prosperous year.

A note of encouragement also comes from Mr. W. H. Farquharson, a well-known Jamaica planter, who publicly stated in England recently that there was no need for the continuance of the present high prices of sugar. As a producer he hoped the high prices would not continue, as they caused decreased consumption.

CUBAN PROGRESS.

In the *Proceedings of the Agricultural Society, Trinidad and Tobago*, August-September 1920, there appears an article, signed by Mr. R. S. Cunliffe, B.Sc., on the progress that has been made by Cuba in the last twenty years.

Cuba occupies at present such a prominent position in the sugar-producing world that the article, much of which is reproduced below, is certain to be of general interest, especially as Mr. Cunliffe resided some years in Cuba on the staff of the Agricultural Department there.

People of the Anglo-Saxon race are sometimes prone to belittle Latin American civilization, but from whatever angle we view Cuba, 'the Pearl of the Antilles,' it is a land filled with interest, with an immense future before it. A land that in twenty years has passed from gnawing starvation and misery to overflowing plenty. From the conditions existing under Spanish colonial rule, a transformation has been wrought in two decades that is hard to realize, except by those who have personally witnessed the process.

The foreign trade statistics furnished by the Cuban Embassy in London, show that the total value of the foreign trade of the island republic during the past official year was $792,800,030, towards which, imports contributed $315,578,167, and exports, $477,221,863, which figures mark a substantial increase over those for the previous year of $302 624,175 and $379,784,285 respectively.

The exports for 1918 were more than twice as large as those from the whole Central American territory, including Mexico, from Texas to Panama.

The city of Havana normally handles a greater foreign tonnage than any other port in the Western Hemisphere, except New York.

Much of this prosperity has been due to the phenomenal expansion of the sugar industry, production having doubled in the last ten years. According to figures issued by the Cuban Department of Agriculture, much of Cuba's cane land is producing at the rate of 22 bags per acre, which, at 15 c. per lb., is over $1,000 per acre. These conditions have brought about a boom in sugar lands. One estate, purchased three years ago for $3,000,000, sold last January for $9,500,000. Another, worth $6,000,000 a few years ago, changed hands at $15,000,000. How receipts from sugar have expanded is shown by the fact that the 1915 crop brought a total return of less than $200,000,000, while that of the 1920 crop is expected to be upwards of $1,000,000,000.

A visit to a large plantation, like that at Preston, is an impressive experience. Although by no means the largest mill in Cuba, so far as grinding capacity is concerned, the property as a whole is a small empire in itself, having its own railroad system, its own police department, its own hospital and fire department. It covers 280 square miles, possesses a population of some 10,000, and nearly 1,200 buildings. Its railroad system has 121 miles of standard gauge track, 25 full sized standard locomotives, besides 800 railroad cars of 20 to 30 tons capacity. About 5,000 oxen are required to haul canes to the loading stations and sidings.

Adjoining it is the Boston plantation, owned by the same company, and they constitute together what is believed to be the largest compact property in the world.

Sugar is supreme at the eastern end of this island, tobacco at the western end. The profits of the tobacco and cigar business bring in from the outside world a great toll. It is only when compared with the sugar trade that tobacco interests seem small. The Cuban factories in 1919 produced 157,000,000 cigars for export—enough, if placed end to end, to stretch one-third of the way round the world.

THE NATURAL RESOURCES OF GRENADA.

Agricultural industries form at present the sole resources of Grenada, the exploitation of which has led to the attainment of considerable prosperity by this island. The soil is in general very fertile, and the greater part of the cultivable land is under permanent crops, such as cacao, nutmegs, and coco-nuts. Limes are also grown, chiefly in the Dependency of Carriacou, where also cotton of the Marie Galante variety is also produced in some quantity.

When sugar prices declined in the latter part of the last century, many of the sugar estates in Grenada were abandoned, or sold out in small lots to peasant proprietors, who began to cultivate cacao, for which the soil proved highly suitable. It seems that at first there was an opinion that cacao would not thrive on the lowlands, and so the first cultivation was carried on at some elevation above sea-level. Now, however, that this opinion has been proved erroneous, cacao cultivation has extended to most of the lands formerly under sugar-cane.

Through the far-sighted policy of the Government, the island is probably as well supplied with good roads as any similar extent of mountainous country in the world. The result of this is that nearly all the cultivable lands in the island are capable of being profitably cultivated. Peasant settlements have been established by the Government, and there are now, it is said, more than 13,000 individual land owners of lots chiefly of under 5 acres in extent.

The gradually increasing area under permanent crops has certain disadvantages. It reduces the area cultivated in annual crops of foodstuffs, and also of grazing land for the supply of meat and milk, with the result of dependence by the general community on imported foods. In the last few years, however, there have been energetic and largely successful measures taken for the greater production of local crops.

DEPARTMENT NEWS.

Sir Francis Watts, K.C.M.G., Imperial Commissioner of Agriculture for the West Indies, returned to Barbados by R. M. S. 'Chaudiere' on December 8, after an official visit to the Leeward Islands.

The following members of the Staff of the Imperial Department also returned by the same steamer to Barbados from the Leeward Islands, where they had been engaged on matters connected with their respective duties: Mr. H. A. Ballou, M.Sc., Entomologist; Miss E. M. Wakefield, F.L.S., Acting Mycologist; Mr. F. Hardy, M.A., Chemist.

Mr. T. G. Mason, M.A., B.Sc, Botanist on the Staff of the Imperial Department, left Barbados for St. Vincent by R. M. S. 'Chaudiere' on December 8, on business connected with his office.

The Secretary of State for the Colonies has been pleased to appoint Mr. F. H. S. Warneford, B.A., B.Sc., to the post of Assistant Government Chemist for the Leeward Islands, as from December 1, 1920.

Dr. S. C. Harland, D.Sc., passed through Barbados on R. M. S. 'Chaudiere' on December 8, on his way to St. Vincent, in connexion with his previous work there as Scientific Assistant for Cotton Research on the Staff of the Imperial Department of Agriculture.

SPACING EXPERIMENTS WITH THE SUGAR-CANE.

Spacing experiments have now been made in many regions where the sugar-cane is cultivated; frequently, however, the results obtained with one variety and one complex of climate and soil factors have been taken as a standard, without proper consideration of the fact that there should be a series of gradations dependent on the variety, soil, rainfall, and cost of cultivation. In this matter, as Barber points out, there is inexhaustible scope for experiment on every plantation, and the maximum output cannot be considered to have been obtained until the matter has been thoroughly threshed out. Barber reports an experiment carried out on Samalkota farm in Madras, in which the number of sets to the acre ranged from 4 000 to 30,000; the result showed that 12,000 to 15,000 were ample for the highest yield, with variations according to the kind of cane planted. This single experiment resulted in saving approximately 20 rupees per acre.

The distance apart between the cane rows has been discussed by Dr. Cross, the Director of the Tucuman Experiment Station, Argentina, in a recent number of the *Louisiana Planter* (Vol. LXV, No. 15); the subject is also considered by Rosenfeld in the *International Sugar Journal* (Vol. XXII, No. 262). In these articles the experiments which have been carried out in different parts of the world are described, and certain general conclusions set forth. No attempt will be made to discuss the experiments in detail but the broad principles underlying the spacing of the plants, which these experiments reveal, should be very carefully considered by everyone interested in the cultivation of sugar-cane.

Theoretically, Dr. Cross states, one would say that the best distance would depend on the fertility of the soil. If the soil is very rich, the distance between the rows should be relatively greater, to permit the cane to attain the exuberant growth the good soil will give it; on the other hand, with a poor soil, the best results should be obtained with rows closer together. Nevertheless, the many investigations carried out on this problem have shown that, even with rich soils, the best yields of cane and sugar per acre are to be obtained by planting the cane in rows close together.

Stubbs published the results of some experiments as early as 1890, using the striped cane (Cheribon), common in Louisiana; the distances between the rows ranged from 3 to 8 feet. It was found that many of the canes died during development, as a result presumably of lack of space for growth. This was particularly noticeable in rows close together; 50 per cent. of the canes in these rows had died before maturity. The fields with rows 3 and 4 feet apart received no cultivation whatever, as no implements could be got into such narrow rows; nevertheless, both as plants and as stubble (ratoons), the rows only 3 feet apart gave the best tonnage of cane, the decrease in yield as between plants and stubble (ratoons) being very small. In both plant and stubble, for some peculiar reason, the cane in rows 5 feet apart gave the second best results in agricultural yield as well as in analysis of juices. This is probably due to the fact that the increased number of plants in rows at 4-foot distances did not compensate for the lack of cultivation, the rows 5 feet apart having been thoroughly cultivated.

Although these results were not particularly surprising, they showed very clearly to the Louisiana planter, who up to that time had been using rows 6 feet apart, that it would be advisable to reduce this distance to 5 feet, since, outside the question of more yield per acre, the cultivation of rows 5 feet apart is far cheaper than that of those spaced 6 feet, because the cane will always close more quickly over the narrower space. Rows 3 feet apart, though giving the largest tonnage, even without cultivation, could not be used in Louisiana, owing to the extra cost which this method of planting implied, in respect of the greater amount of cane necessary for the purpose, and the greater cost of the labour necessary for the operation. These expriments also indicate that, if cultivation with spade and hoe had not been impossible for economic reasons in Louisiana, the superiority of rows 3 feet apart would have been much greater. These experiments were, however, only carried out for two years; for, as is well known, cane is usually planted in Louisiana every other year.

As the result of these and subsequent experiments in Louisiana and in other parts of the world, notably in Java, it would appear that, though it cannot be said at just what distance the cane will give best results in tonnage and purity yet cane is essentially a sociable plant, and should be planted as close together as will permit of thorough cultivation. This seems to be the chief lesson of all the experiments which have been carried out in this direction.

THE SUGAR INDUSTRY OF PERU.

At the meeting of the American Chemical Society held at Chicago in September this year, an interesting paper on the above subject was read by Chas. A. Gamble, which was published in the *Louisiana Planter*, October 16, 1920. From this the following paragraphs are reproduced.

Sugar-cane was first introduced into Peru shortly after the Spanish conquest by Pizarro, early in the 16th century, but it was about the last quarter of that century before the first sugar was commercially manufactured. The industry never assumed importance until about 1860, when an influx of foreign capital enabled the erection of factories equipped with modern machinery, and Peru became a sugar-producing country. In 1878 this flourishing industry was all but destroyed, owing to the disastrous war with Chili, and the country was so racked with civil wars following the Chilian invasion that it was as late as 1895 before there was a peaceful period. About the year 1906 the Peruvian Government established a sugar experiment station in Lima, and it is owing to the good work done at this station that the cultivation of sugar-cane and the manufacture of sugar therefrom has become one of the principal industries of the republic, until at the present time there are fifty or more centrals raising sugar-cane and making a high grade of sugar.

As Peru is mostly mountainous, the cultivation of sugar, cane is conducted entirely in the narrow but fertile coastal valleys, and only in a few instances does this cultivation extend more than 15 or 20 miles inland. These coastal valleys are all watered by small rivers which have their sources further back in the mountains. During the rainy season in the interior of the country, these small rivers carry an abundance of water, but in the dry season there is such a scarcity of water that it has been necessary for the Peruvian Government to appoint engineers to regulate the amount of water each estate may have, and to see to it that there is no wastage. Under these conditions there is always a sufficient supply of water. The importance of the governmental regulation of the water supply will be understood, when it is known that rain never falls upon the coastal regions of Peru.

There has been considerable research work done at the sugar experiment station and agricultural college in Lima, to determine the variety of cane best adapted for growing in Peru, but up to the present it does not seem that any one particular variety has better qualifications than another. All varieties seem to thrive and develop equally well.

This is probably due to three causes, namely, the even temperature, control of moisture, and the intensive use of guano. The temperature of the coastal valleys does not vary more than 10 or 15 degrees between summer and winter. The entire lack of rain gives to the agriculturist an absolute control of the amount of water that goes upon the canefields, and the nearness of the great guano deposits, and the cheapness of this rich fertilizer make the intensive use of it possible; thus the sugar-cane enjoys and thrives under advantages that probably are seldom found elsewhere

After the field has grown successive crops of cane for six to eight years. the cane is killed by deep ploughing, the field fertilized with about 3 tons of guano per acre, and replanted with cuttings of cane from another field. Healthy stalks of cane are selected, and cut into pieces of about 12 inches long, and these cuttings are placed into shallow trenches previously prepared, covered with the soil, and irrigated. A field thus planted requires about twenty-two months to mature. In the ordinary course of procedure, after the cane has been cut and taken to the factory, the field is irrigated thoroughly, and the stools immediately commence their new growth. A field so treated requires about eighteen months to mature.

It is customary in Peru, when a field of cane is matured and ready for cutting, to clear the field and cane of trash, leaves, etc., by means of fire. It is believed that the cane suffers no harm from this burning, provided it is cut and taken to the mill within forty-eight hours.

The cane is of a good quality, both in sucrose content and tonnage. It is a very usual occurrence to have cane average 50 tons per acre; 40 tons per acre is considered very ordinary, and anything below this tonnage is considered poor. The sucrose content will average 15 to 16 per cent sucrose in the cane for the crop, and have a purity of 85 to 88. The glucose is comparatively low, having a glucose ratio of 3 to 5.

The factories of Peru are usually of 200 tons to 400 tons capacity per twenty-four hours grinding, although there are a few that have a capacity of 1,200 to 1,400 tons per day.

A few years past very few factories or estates maintained chemists, regarding them and laboratories as unnecessary expenses; but to-day there are very few centrals that do not have their own laboratory, and maintain chemical control of their factories and fields.

Peru enjoys advantages that are not had in many other countries. Besides the advantage of climatic conditions, and the heavy tonnage of cane per acre, is the fact that the factories grind during an average of ten months of the year, and some of them grind continually all the year, only stopping long enough to clean and repair the machinery.

Some idea of the development of the sugar industry of Peru during the past ten years may be gained from the fact that in 1910 the sugar production amounted to about 150,000 tons In 1916 it reached 276,000 tons, but in the past year it fell off to 250,000 tons. This falling off in production was no doubt due to the planters being tempted by the high price of cotton, and the great demand for that article for war purposes, to plant more cotton and less cane.

The tendency of the factories is to make a better grade of white sugar, beginning to realize the fact that it is possible to produce a high grade, clean, white sugar direct from the cane; and the near future will probably see them all making a high grade of white sugar.

RAINFALL AND CROP GROWTH.

The exact relation between climate and the growth of crops, and the possibilities of accurate forecast of production based on the weather at certain times of the year, have been engaging the attention of agricultural scientists in many parts of the world. *Nature*, October 28, 1920, draws attention to some investigations recorded by Mr. T. A. Blair in the *Scientific Monthly* for October. It seems that Mr. Blair shows, in the case of maize in Ohio, that the United States Weather Bureau has found that a rainfall in July of less than 3 inches means an average yield of 30 bushels of corn per acre, and that a rainfall of 5 inches or more in the same month results in a yield of 38 bushels. When the July rainfall is $3\frac{1}{4}$ inches the yield is 15,000,000 bushels greater than when it falls short of that amount by $\frac{1}{2}$ inch. In the four great maize-growing States of Indiana, Illinois, Iowa, and Missouri, the addition of $\frac{1}{2}$ inch to a total of $2\frac{3}{4}$ inches adds 10 bushels per acre to the average yield.

A more precise relationship is found in the idea of a critical period—that is, certain short periods of time in the growth of any crop, during which its future prospects are largely determined. With some crops this is a single period; with some it is temperature, and with others, rainfall or sunshine at some special period of growth, which is the most important factor.

The application of this knowledge may be used to increase production in two ways. First, it will be possible to determine what crops are climatically suited to a particular district; and secondly, by the use of early or later maturing varieties, and by the help of fertilizers or other means, the crop may be advanced or retarded so as to bring the critical period into coincidence with favourable weather.

Readers of the *Agricultural News* may recall that some observations on the effect of rainfall at the critical period of growth of cotton have been made in St. Kitts by Mr. Kelsick, the Assistant Government Chemist in that island. There is much room, however, for further investigations on these lines, not only with regard to cotton, but other staple crops of the West Indies. As was noted above, accurate information with regard to the critical period in the growth of any crop would not only be interesting, but advantageous on account of increased production. In the cases of most West Indian crops, the best time of the year for sowing or planting is probably derived from traditional practice. It would, however, seem worth while basing the practice on accurate knowledge of the critical period of growth of each variety.

A comparison of the figures of the production of petroleum oil in Mexico, in the United States, and in the world, shows that the Mexican production has multiplied more than three times in the last seven years. While in 1913 Mexico supplied only one-fifteenth of the world's production of oil, in 1918 it furnished more than one-eighth. Statistics denote that the world's actual production of oil in 1918 was about 515,000 000 barrels. The potential production of the wells already drilled and producing in Mexico is estimated at from 1,500,000 to 1,900,000 barrels daily, but only about 12 per cent. of the potential capacity of the wells in Mexico is being actually produced (*Journal of the Royal Society of Arts*, November 5, 1920.)

COTTON NOTES.

COTTON GROWING WITHIN THE BRITISH EMPIRE.

At the Tenth International Cotton Congress held at Zurich in June last, Mr. John W. McConnel, of Manchester, read a paper on 'Cotton Growing within the British Empire', the main points of which are worthy of consideration by everyone interested in the cotton industry.

In introducing the subject, Mr. McConnel alluded to the really serious nature of the position as regards the need for cotton; a position the seriousness of which could scarcely be over-exaggerated. The price of cotton began to rise even before the war, showing an increasing excess of demand over supply. During, and since the war, the shortage had become acute. It is doubtful even by the spending of large sums of money, and by energetic action, that the production of raw cotton could be rapidly increased. As far as the British Empire is concerned, were immediate increased production possible, the question of facilities of transport, whereby the raw cotton can be brought from the regions where it is grown to the factories where it is made into goods, is one of almost overwhelming difficulty. It is estimated that £10,000,000 could probably be spent in developing railways within the Empire, in order partly to meet the demands for efficient transport. In Africa especially is the need for improved railway conveniences most urgent. There is cotton in Nigeria and Uganda that cannot now be brought to the coast.

Turning to the agricultural side of the subject, there are many factors which require careful attention, if the supply of cotton is to be made equal to the ever-increasing demand.

In the majority of the cotton-growing districts of the Empire there is need of a more thorough spread of knowledge as to the requirements of the cotton plant. More agricultural instructors are wanted to show native growers how to produce better results, and how to adapt methods of cultivation to the peculiarities of the environment. While there has been in recent years, especially in the United States, some advance in the exact science of cotton growing, there is still a great need of extensive and detailed research, and of education in research methods. Knowledge of the botanical characteristics of the cotton plant, and of the nature of the pests which tend to limit its productivity, must be accumulated, and the discovered facts applied more thoroughly to the actual growing of the crop in the field. Steps must also be taken in the economic side of the question, so that the cultivation of the best strains of cotton may be encouraged by the payment of a higher price for good quality cotton.

To meet certain of these desiderata, the Empire Cotton Growing Committee, set up by the Government during 1917, began investigations into the question of increasing the supply of cotton in the British Empire. The main purpose of Mr. McConnel's paper is to present the chief facts of the whole subject concerning the possible improvements that could be made to meet the acute situation, and to interpret the findings of the Empire Cotton Growing Committee, of which Mr. McConnel was an active member.

The paper is divided into three parts. The first summarizes the recent progress made in the British Empire in the matter of cotton growing. The second part deals with prospects of the future, and the means that must be taken if cotton growing is to be developed. The last part of the paper gives a review of the different countries within the Empire in which cotton is now grown. An appendix to the paper deals with the recommendations of the Empire Cotton Growing Committee. Since these have already formed the subject of an article which has appeared in the *Agricultural News*, March 6, 1920, p. 68, the matter need not be reconsidered here.

As to the signs of progress already made, Mr McConnel points out that the report of the Empire Committee, presented in January 1920, and that of a similar committee elected by the Indian Government, has each been accepted by the Government to which it was addressed, so that for the first time the British and Indian Governments have taken the welfare of cotton growing under their supervision and sanction. There has also recently been a noteworthy increase in the interest which the subject has aroused in the British public. It is at last being realized that it is to the cotton fields within the Empire that the manufacturers of Lancashire must turn for their supply of raw material, and that the spirit of unity of interest within the Empire must be fostered. While such an object should occupy our main attention, still the doctrine of Free Trade must not be discarded, for it is not to be desired that the use of British-grown cotton should be legislatively confined to British mills. Hitherto the cotton grown in India, Egypt, and elsewhere within the confines of the Empire has been available for all nations, and it must be reiterated that it is the world's shortage of cotton that the Empire Cotton Growing Committee seeks to make good.

That the Lancashire manufacturers realize the great importance of the principles already mentioned, is indicated by the fact that they have agreed to allow a charge of 6*d.* per bale on all cotton used in the United Kingdom, and this for the purpose of developing cotton growing in British fields. This levy will bring £100,000 per annum, but it is hoped that a much larger sum than this will shortly be realized as the result of organized effort on the part of the Lanschaire spinners. A further very hopeful sign for the future is the marked change in the attitude of leaders of industry towards the application of scientific knowledge to their peculiar problems. This change has been largely due to war time experiences. It is also becoming evident that greater attention is being paid to the organizing of larger and better agricultural departments within the Empire, to the more thorough training of instructors and teachers of agriculture, and to the initiation of research into agricultural problems connected with the growth of the cotton crop.

Turning next to the prospects of the future, Mr. McConnel states that success wil depend in large measure upon the encouragement given to investors of capital, to place their funds at the disposal of the Government for the purposes of promoting better methods of cultivation, and of providing the larger means of transport, such as harbours, railways, waterways, and main roads. Smaller ventures, such as the establishment of transport by motor vehicles and boats, might better be provided by private enterprise, and these will, of necessity, rest primarily with those who are already interested or engaged in the cotton industry. There are also many opportunities for direct investment in companies, such as the Aboukir Company of Egypt, which undertakes extensive schemes of land reclamation, irrigation, and drainage. The greatest need of all is for a large syndicate of men interested in the cotton industry, who will be prepared to begin with a thorough study of the conditions, both general and local, that are likely to determine the lines along which improvements might be made.

The possibilities of cotton development in the British Empire might best be indicated by considering the question in its relationship to the several countries which are known to produce cotton, or which may be expected to do so in the future.

As regards India, the report of the Indian Committee makes it clear that gradual improvement in the quantity and quality of the cotton grown there is to be looked for, rather than a sudden or rapid increase in output.

In Egypt the question of increasing cotton production depends chiefly on measures for the better conservation and administration of the water of the Nile. Improvements in the drainage and irrigation of the Nile delta are now being undertaken, and these are expected to add very materially to the acreage of productive land under the cotton crop. The scheme of improvements in the delta will take some fifteen to twenty years to complete, and will necessitate the outlay of approximately £36,000,000.

In the Sudan, a scheme to put 100,000 acres of the Gezira plain immediately under cotton cultivation promises well It may be supplemented at some future date, so that ten times this area of land will in due course be devoted to the growing of cotton. Other parts of the Sudan, including even the rainy districts to the South of Khartum, may eventually be utilized for cotton growing, so that there are almost unlimited possibilities in this country alone.

Finally, turning to the rest of British Africa, great possibilities in Uganda, Nigeria, Nyasaland, Rhodesia, and the Union of South Africa also present themselves. The chief needs in these countries are for transport, both on a large and on a small scale, and for great increase in the size of the staffs employed in the various agricultural departments.

In the West Indies cotton growing is firmly established, and partial compensation is here secured for the destruction of American Sea Island cotton by the boll weevil.

In Mesopotamia the chief difficulty at present lies in the political situation. Provided that this can be amicably settled, there are good prospects in connexion with the establishment of a flourishing cotton-growing industry in that area.

Having regard to all the conditions, it is evident that a very great and thoroughly organized effort is necessary, if Great Britain is to secure the supply of cotton essential to the maintenance of its vitally important cotton industry.

THE SELECTION OF TURKEYS.

The above subject is discussed briefly in an article appearing in a recent number of *The Field* (October 2, 1620). The points more or less prominently brought out are reproduced below, as of interest to poultry raisers in these West Indies.

The attainment of full maturity is a slow and gradual process in turkeys, which are not capable of breeding the best young stock until they are two or three years old. This fact has been so frequently ignored by English and other breeders as well, that it is one of the two most common causes of non-success, the other being injudicious in-breeding. The beginner cannot, of course, always secure suitably mature stock with which to start turkey breeding, so that, in common with those who require to renew their existing stock, a selection must be made from among the young birds of the year. This is a very favourable season in which to make such a selection, because the birds that were hatched at a suitable period, and have been reared on a good range, should have made sufficient progress to make it possible to distinguish the most promising individuals in a flock. Such a choice must, in any case, be made between now and the time when the birds to be killed at Christmas are penned for fattening, as they should be about a month before the killing date.

Although excessive size is not desirable in breeding stock, there are many who breed from birds that are too small, as the result of their injudicious selection of the best for sale. The only way to improve and maintain the stock of turkeys is to reserve the best of each succeeding generation, irrespective of any outside requirements, selecting those of robust health and sturdy growth, and discarding all in which any sign of weakness has been detected. The bird of good type that is developing a good medium size is preferable, for the practical purpose, to one that bids fair to make great size and extremely heavy weight—however desirable these may be in the show pen. In the same way, colour is of secondary importance in selecting for this purpose, although breed characteristics should not necessarily be ignored. As regard breed differences, the American Bronze is capable of making great size and weight—as may be seen at the bigger shows where these birds are exhibited—but the White or Black varieties are usually of more moderate size, and more particularly suited to the general demand for table birds of medium weight. Whilst it is true that the best birds are bred by mature stock, it is desirable for the general purpose to select those that are not characterized by extreme size and weight when they attain maturity.

Birds that are slowly and healthily developing will shape into much more reliable breeders than those that have been in any way forced. There is a natural correspondence between weight and maturity, and freely reared birds may not be as heavy as some others, but—next to sound health—bone and muscle should be looked for in the selection of breeding stock, although a good frame is not necessarily a large one. In respect to standard requirements, some of the best breeding stock for the practical purpose would be unsuitable for the production of exhibition birds not only, of course, as regards colour and markings, but particularly in relation to size. This last is for the exhibition breeder a point of primary importance, and it is usual to select much larger and taller birds for his purpose than would be profitable in market production. Proportion is, of course, a desideratum, but apart from the general symmetry, the length of breast bone is a detail of first class importance. There is often a wide difference in this respect, and choice should always be made of birds with a long breast, which is also broad and deep, rejecting those that are short in the breast bone, flat or shallow, or in which there is any defect in the keel formation. But the breast must be well balanced by the remainder of the body, and in this connexion the back is an important consideration; the curve should rise gradually from the base of the neck, and fall gradually to the tail, straight or hunched backs being avoided.

EDITORIAL NOTICES.

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The complete list of Agents will be found on the last page of this issue.

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NOTES AND COMMENTS.

Contents of present issue.

The outlook for the sugar industry forms the subject of the editorial of this issue.

An article referring to experiments as to the proper distance apart at which to plant sugar-cane will be found on page 388.

The prospects of increased production of cotton within the British Empire is the subject of an article on page 390.

Interesting experiments conducted in India on the beneficial effects of the fermentation of green manure are described on page 394.

The improvement in crop production in India which is taking place, is the subject of an article on page 398.

The West Indian Tropical Agricultural College—A Mistake Corrected.

In *The Times* Trade Supplement, October 16, 1920, a letter appeared over the signature 'Guy Wyatt', which begins with the statement that 'the West Indies generally are apparently disunited over the proposed Tropical Agricultural College in Trinidad'.

The incorrectness of this statement was shown in the next week's issue of *The Times* Trade Supplement, in a letter from the Hon. Secretary of the Tropical Agricultural College Committee, Mr. Algernon Aspinal, from which we quote the following :—

'As statements of this kind are calculated to do harm, will you permit me to say that, far from the West Indies being generally disunited, a majority of those colonies, comprising Barbados, Trinidad and Tobago, Grenada, St. Vincent, St. Lucia, and the Leeward Islands, has already pledged itself to support the college, while Bermuda, though not a West Indian colony, has shown its sympathy with the movement by agreeing to make an annual contribution towards the maintenance of that institution?

'A definite decision has not yet been reached in British Guiana and Jamaica; but it is hoped that the legislative bodies in these colonies will approach the matter in a broad-minded manner, and agree to participate in the movement.'

Apropos of this subject, an editorial note in the *Australian Sugar Journal*, September 3, 1920, in referring to the proposed College in Trinidad, reviews the scheme with approval, and especially draws attention to the fact that the College is meant to train men, particularly specialists, in tropical agricultural subjects for services far beyond the bounds of the West Indies. It is also pointed out that there is at present an absence of facilities for such a training in Australia, and the suggestion is thrown out of a system of scholarships to encourage some of the Australian young men to devote themselves to a scientific career. The note concludes with the following appreciative remarks: 'In this West Indian scheme there may be found later on the right place to which they can go for an advanced and special training in subjects connected with the sugar industry. Apart from this aspect, the proposal is noteworthy, as showing the general trend in all countries towards scientific education.'

Bamboo as Fodder.

That horses and cattle will readily eat the leaves of the bamboo is well known in the West Indies. The plant, however, is not anywhere grown in these islands for the purpose of providing fodder, although in some of them the leaves are considered a valuable remedy for 'broken wind' in horses, which seems also to be the belief in some parts of India.

From an article in the *Agricultural Journal of India*, July 1920, it appears that the species of bamboo, *Dendrocalamus strictus*, promises to be a

most useful fodder plant for poor, light soils which cannot be irrigated. This bamboo grows in dense tufts, and is gregarious, occurring on moderately dry hills through most of India and Burma. It does not flower until after about thirty years, and after flowering the plants die. This bamboo does well, it is stated, on poor gravelly soils of the Central Provinces, where the rainfall averages from about 45 to 60 inches per annum.

An experiment, conducted on the Chandkhari Farm, Raipur, showed that from seedlings raised in a nursery, and planted out at the beginning of the rains, a first cutting, taken after three years growth, yielded 19½ tons of green fodder per acre, which was much relished by the farm cattle. There is reason to believe, the article states, that yields of from 40 to 60 tons of leaf per acre can be obtained annually from this variety of bamboo three years after planting.

With regard to nutritive value, bamboo leaves appear on analysis to be at least equal to most Indian grasses, while the yield per acre is much greater than that obtained from grass on similar soil.

The article concludes by suggesting many other uses to which this bamboo could be put: its seed is a nutritive food grain, and its young and tender shoots a palatable vegetable; its mature stalks are used in the manufacture of mats and furniture, and when split, as a fence for cane and vegetable plots.

It may be noted that this species of bamboo, often called 'male bamboo,' is to be seen growing at the Botanic Garden, Dominica, and also in other West Indian islands where it has been introduced from India.

Power Alcohol from Rice Straw.

According to an article in *Nature*, October 21, 1920, dealing with possible new sources of power alcohol, an interesting recent proposal has been made. This is, that alcohol for industrial purposes may be obtained from rice straw and husks, a cheap raw material available in large quantities in rice-growing countries. The process proposed is to soften the straw by steaming; it is then treated with hydrochloric acid, or with calcium hypochlorite and chlorine, to disintegrate the fibres; it is then pulped, and the hydrolysis of the cellulose and starchy matter completed by means of diluted hydrochloric acid. After the conversion of the sugar takes place, the acid is neutralized, and the solution of sugars fermented and distilled. It is stated that arrangements have been made for large scale experimental trials of this process in India, with the view of ascertaining whether the production of fuel alcohol from these and similar cheap cellulose materials can be definitely established.

Experiments are also in progress to ascertain whether a micro-organism can be obtained which will effect the direct conversion of cellulose into fermentable sugar. Success on the lines of this or the preceding process would open up the prospects of utilizing a large amount of waste cellulose substances as sources of industrial alcohol.

Queen of Flowers—A Correction.

In a note under the above heading in the *Agricultural News*, October 30, 1920, it was stated that the tree (*Lagerstroemia Flos Reginae*) grew readily from seed, and attained large dimensions in a short time, yielding a valuable timber. This is the case in Assam and Burma, according to a bulletin of the Indian Forest Research Department. Under West Indian conditions, as in Dominica, Mr. J. Jones, Curator of the Botanic Garden, writes to point out that the contrary is the case. The tree does not attain to a large size there; it is slow growing, and of little use for timber; nor does it grow readily from seed. We have pleasure in making this correction, but, *pace* Mr. Jones, the tree is commonly known in the West Indies as 'Queen of Flowers' and not 'Queen Flower,' even though its specific botanic name is, of course, to be translated 'The Queen's Flower.'

A Berry Poisonous to Pigs.

There is a well-known ornamental small tree, called generally in the West Indies 'Lilac,' the botanic name of which is *Melia Azedarach*. As an ornamental it is prized for its fernly foliage, its conspicuous and fragrant panicles of flowers and the bright yellow berries which succeed.

From the *Queensland Agricultural Journal* September 1920, it appears that a variety of this species — *australasica*, — is indigenous to the northern districts of Queensland, where it is known as 'White Cedar.' Mr. C. T. White, F.L.S., Government Botanist, Queensland, has issued a warning against allowing pigs to eat the berries, which they will do if they can obtain them. He finds that the berries have been proved in several instances to have been highly poisonous to pigs which have devoured them.

He goes on to quote from a Dutch botanist, who has made a careful study of the properties of this plant, that the bark contains a substance which is stupifying to fish, and that the narcotic properties are due to a saponin.

Mr. White also remarks that fruit-eating birds are said to eat the berries without any subsequent ill effect, and that he has been told that pigeons, ducks, and fowls also eat the berries with impunity.

In connexion with this plant, which was brought to the West Indies from India, certainly more than a hundred years ago, there is a wide-spread superstition among West Indians that a flowering branch of it has remarkable power over the denizens of the spirit world. Among the more ignorant, therefore, such a branch may often be seen suspended over the door of a hut, for, the purpose of preventing the intrusion of 'jumbies,' or 'duppies.'

Although the opinion that the berries are poisonous is wide-spread in the West Indies, yet we have never heard of any cases of pigs or other animals having been poisoned by the variety existing there.

THE FERMENTATION OF GREEN MANURE.

In the *Year Book* for 1919 of the Madras Agricultural Department, there is an interesting note by Dr. Roland V. Norris, Government Agricultural Chemist at the Coimbatore Central Farm, on the fermentation of green manure, much of which is reproduced below as possibly affording valuable hints for planters in other tropical regions besides Madras.

While the changes involved in the rotting of farmyard manure have received the attention of a large number of workers, and are beginning to be understood in some detail, the fermentation of green manure has been comparatively little studied. This is perhaps only natural, as in the case of farmyard manure, owing to the necessity for storage, the fermentation changes resulting have always been prominently brought to notice, and the obvious necessity of attempting to control the process in order to prevent loss of valuable manurial ingredients has led to numerous investigations. In the case of green manures, however, there has been no necessity for storage, and the changes taking place after the addition of the manure to the land being therefore far less obvious, have attracted much less attention.

In view of the wide-spread use of green manure, it seems highly desirable that the changes taking place after its application to the soil should be thoroughly studied, for these changes, in addition to providing direct plant food, have a considerable influence on the mineral constituents of the soil, and little is as yet known as to the nature and extent of this influence, or as to how far it is capable of control.

In order to prevent the wastage of nitrogen which occurs when green nitrogen is added to the soil, it has been proposed to collect the green manure in pits, and allow it to rot, and then to apply the fermented manure to the land. There is an economic objection to this method, viz. the cost of labour. Dr. Norris states, however, that on the Central Farm, Coimbatore, experience would appear to indicate that the extra cost is more than compensated for by the advantages gained. The most obvious advantage is that the fermentation involved is capable of a large measure of control. For instance, the degree of aeration can be varied, as can also be the amount of moisture, and by the addition or not of substances such as lime and other salts, the nature of the fermentation can be modified to a very considerable extent.

A second advantage, moreover, is that the manure is brought into a much more readily available form, and therefore the immediate return should probably be greater.

Little work, however, has been done as yet in the study of the control of the fermentation, or of the changes produced in the various products of the fermentation, by alterations in the conditions. A certain amount of information can be derived by considering some of the changes which take place in the fermentation of farmyard manure. This subject has recently been studied in detail at the Rothamsted Experiment Station by Russell and Richards. They recommend, as a result of their investigations, that farmyard manure should be stored under conditions as completely anaerobic as possible, and at a temperature of about 26° C. It may reasonably be expected that in fermenting green manure the least loss of manurial ingredients will occur under something like the same conditions. The course of the fermentation can be modified in other ways. It has been shown that by the addition of lime the fermentation of green manure in the soil, as measured by the evolution of carbon dioxide, is considerably accelerated. Experiments seem also to indicate that this is not the only result, the type of fermentation in presence of lime leading to changes of a putrefactive nature, and a more rapid and complete decomposition of the green manure.

There is another aspect of the case to be considered. There is abundant evidence that the products of fermentation of organic matter, such as green manure, have a powerful solvent action on insoluble mineral fertilizers, such as rock phosphate, etc., and render these more or less available.

The best method of applying this property would appear to be the addition to the fermenting green manure of the mineral fertilizer in a pulverized condition before application to the land. Phosphate, for instance, would assist in the fermentation by preventing undue accumulation of acid. The net result would therefore be the production of a highly decomposed manure, containing a considerable amount of soluble phosphate, and with a large proportion of its nitrogen in the most suitable form.

Another important consideration remains. One of the chief functions of green manure is its indirect action in leading to thorough aeration of the roots. This action is derived from the fermentation of the carbohydrates present in the manure, leading to products which result ultimately in the liberation of oxygen. In any preliminary fermentation a good deal of the carbohydrate matter will be destroyed, and it will be a matter for experiment to determine whether the anticipated saving in nitrogen compensates for this loss.

It would seem that there are many possibilities of improvement in the present system of the employment of green manures. But much further experimental work is required to see how far these possibilities are capable of realization. It is not necessary, however, that field trials should be delayed until the completion of laboratory experiments. On the contrary, comparative experiments, using plots treated in the ordinary way, and plots in which the green manure added has undergone a preliminary fermentation under various conditions, should yield results of a highly interesting and instructive nature.

TREATMENT OF SEEDS WITH CHEMICAL DISINFECTANTS.

An article by Harry Braun, which appeared in the *Journal of Agricultural Research*, July 15, 1920, gives an interesting account of results obtained by him in experiments on a method of seed treatment, whereby injury to seeds, due to chemical disinfectants, may be prevented, and the germicidal efficiency of these disinfectants may be increased. This method the author designates as the 'pre soak' method.

It is pointed out that the wide-spread use of formalin, copper sulphate, and other germicides, in the treatment of seeds for the control of seed-transmitted diseases, is generally followed by decreased and retarded seed germination. Pathogenic organisms on the seed-coats, such as bacteria, fungus spores, or mycelia, are usually in a resting or dormant stage, and require the use of disinfectants in a fairly strong concentration—1 to 80 for copper sulphate, and 1 to 200 or to 320 for formalin; these strong solutions often act detrimentally on the germinating seed. Even much weaker solutions exhibit retarding and killing effects on some seeds.

In the course of investigations on a bacterial disease of wheat, a new treatment of seed-wheat with formalin or with copper sulphate has been discovered, whereby seed injury

due to these disinfectants is either eliminated or reduced to a negligible minimum, while at the same time the bacteria are rendered more susceptible to the action of the disinfectant. The result has been accomplished by the application of a fundamental principle of bacteriology, and of an established law of physico-chemistry. The first is that micro-organisms in an active vegetative condition or just resuming activity, are more susceptible to destructive agents than when in a dry or dormant state; the second is the law governing the diffusion of dissolved substances, whereby a solvent has a diluting effect on any stronger solution diffusing into it.

In accordance with these principles, wheat seeds were first soaked in tap water for ten minutes, drained, and kept moist for some hours, then soaked thoroughly in formalin solution (1 to 400) for ten minutes, drained, and kept moist for some hours more. The first soaking was done in order that the water absorbed might weaken the solution diffused into the cells, and so result in less injury being done to their germinating power. After this, numerous experiments were made varying the length of time during which the seeds were kept moist, but always starting with a preliminary short plunge into water.

As a result of these experiments, several facts seem to be established. First, in all cases, with each variety of wheat, barley, oats, and maize tested, the presoak method minimized or eliminated the injury to seed germination due to the use of formalin or copper sulphate. Second, a marked stimulation of growth was usually produced. Third, the method proved fully efficient as a means of destroying or preventing the growth of the bacteria of the disease borne on the seeds, and can doubtless he applied for the prevention of other diseases. Forth, the method is simple and adaptable to field conditions.

The method of treatment which seemed to give the best results was as follows: oats, wheat, and barley were soaked in water for ten minutes, drained and kept moist for six hours, then soaked in formalin solution (1 to 320) for ten minutes, and covered for six hours more. Maize, which absorbs water much more slowly than the other cereals, and which is also less susceptible to formalin injury, was given a ten-hour presoak—that is ten minutes in water, draining and covering for ten hours, followed by four hours formalin (1 to 200) treatment.

The saturation of the seed cells and cell walls with water during the presoak period appears to be the factor counteracting the injurious effect on seed germination, by diluting the disinfectant beyond the point of injury as it diffuses into the tissues.

It may be noted that the actual stimulation of germination, which has been observed repeatedly in these trials, minimises, by shortening the time of germination, the danger of exposure to the attack of injurious organisms which may be present in the soil during this susceptible period

The use of the presoak method tends to increase the efficiency of the disinfectant, in that the presoaking stimulates dormant bacteria, and possibly fungi, into vegetative activity, thereby rendering them extremely susceptible to the subsequent action of the disinfectant.

Of West Indian crops, cotton, corn, and beans are, of course, sown by seed. The treatment of cotton seed with sulphate of copper solution before planting has been sometimes, and perhaps still is, practised for disinfecting purposes. The process noted above may perhaps be employed usefully wherever the presence of seed-borne pathogenic organisms may be suspected on cotton or other seed.

AGRICULTURAL EDUCATION AND RESEARCH IN THE UNITED KINGDOM.

Nature, October 28, 1920, notes an important change at the Ministry of Agriculture, in the promotion of Mr. F. T. L. Floud to be Permanent Secretary, whereby Sir Daniel Hall is liberated from office work, and enabled to devote his whole time to the organization of agricultural education and research with which Sir Daniel has always been closely associated.

It is stated that the scheme now in operation comprises four essential parts:—

(1) Research Institutions, where knowledge is gained, and agricultural science systematically developed and put into such form that teachers and experts can use it. At first this work was distributed among a number of university departments, but of recent years there has been a tendency to concentrate it at a few institutions, owing to the necessity for bringing individual workers into closer personal contact with each other and with the large-scale problems of the farmer.

(2) Agricultural Colleges, where experts and large farmers will be trained, receiving a three-years' course of instruction of university character. Most of these colleges are associated with universities which award degrees in agriculture; for students who do not wish to take degrees, there is a diploma course requiring a high standard of technical work.

(3) Farm Institutes for small farmers and farm-workers who cannot spare three years for college, but have some practical knowledge, though they are unable or unwilling to go through the ordinary college course. These institutes aim at giving sound courses of instruction on soil, manure, crops, animal husbandry, etc., but it is usually presumed that the student will take up farming in the area served by the institute, and for which the instruction is specially appropriate.

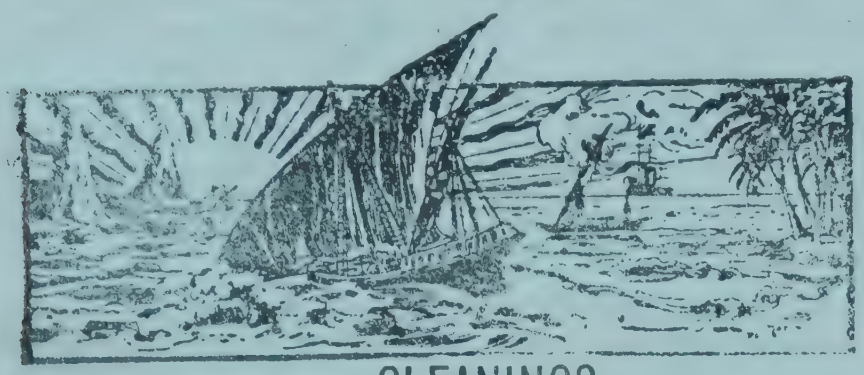
(4) Advisory Officers. In each county arrangements are made whereby farmers, small holders, and others may consult the agricultural expert appointed by the county authorities, in regard to any difficulties they may meet with in their work. The adviser is in a position somewhat similar to that of the general medical practioner, and usually finds that he can deal with a large number of the cases presented to him. He is, however, in touch with the colleges, research institutions, etc., and can always obtain expert advice in any particular problem of special difficulty.

AGRICULTURE IN BARBADOS.

The weather during the last fortnight of November has been very favourable. Since November 11, rain has fallen every day. On the above date a considerable amount of wash resulted from the heavy rains. The rainfall recorded in Christ Church is $5\frac{1}{2}$ inches so far; in the centre of St. George $5\frac{3}{4}$ inches; and on the red soils $8\frac{1}{4}$ inches. The amount registered for the year on the red and black soils is $51\frac{1}{2}$ and $34\frac{1}{2}$ inches respectively.

The past rains have produced a great change in some parishes, and planters have been greatly aided in making progress with the cultivation of their fields. It may be observed that the B.H. 10 (12) has not recovered in the black soils as much as the B 6450 or the Ba. 6032.

The cotton crop in Christ Church is excellent. In St. Peter there are also some good fields. The price of cotton has dropped considerably, and the planting of it will not be as lucrative as was expected. (The Barbados *Agricultural Reporter*, November 27, 1920.)



GLEANINGS.

It is interesting to note that in Iceland, where there is very little pasturage, particularly in winter, a correspondent of the *Journal of the Royal Society of Arts*, November 5, 1920, states that the sheep near the coast go down to the beach, and climb amongst the rocks to obtain seaweed which they use as food. The seaweed, however, gives rather a peculiar taste to the flesh of the animals.

The Directors of Home-Grown Sugar, Limited, have recently stated the terms they offer to the farmers to grow sugar beets for the factory at Kelham, Newark on Trent, next year. The price is 80*s.* a ton delivered at the factory; and the opinion is expressed that at that figure the crop should yield a generous profit to growers after allowing for increases in the labour and other costs of production and transport. (*The Field*, November 6, 1920.)

It appears that plans are in progress for the establishment of a paper mill in Southern Saskatchewan, for utilizing the thousands of tons of waste straw in that Province. Close proximity to an adequate supply of cheap coal is one of the essentials for success, and it is believed that the lignite fields of Southern Saskatchewan offer the necessary fuel requirements. Straw, hitherto burned, will thus be converted to economic purposes. (*United Empire*, October 1920.)

The New South Wales Department of Agriculture and the Queensland Government have arrived at an arrangement designed to encourage the growing of cotton. It is anticipated that upwards of 3,000 acres will be put into cotton during the next two months. Planting has already begun in some districts. The official estimate is that 1,000 lb of seed-cotton per acre can be set down as the average yield. (The *Chamber of Commerce Journal*, October 29, 1920.)

The Hawaiians have splendid chemical control in their sugar factories, according to the report of the chemists. In 1919 the extraction was as near perfect as chemists have as yet been able to obtain, one sugar concern being able to extract 99·05 per cent. of the sugar in the juices. Other factories have extracted a percentage of 98·99, and the majority of them have obtained 97 per cent. sugar extraction. The sugar losses in ten years have been reduced 27 per cent. (The *Louisiana Planter*, October 30, 1920.)

In a note in the *Perfumery and Essential Oil Record*, October 1920, it is stated that the total export of bay rum from the islands formerly known as the Danish West Indies, but which are now the Virgin Islands of the United States, amounted in 1919 to 84,545 gallons, valued at $66,798, of which 9,012 gallons went to the United States. These figures are considerably higher than those for 1918. A still further increase in value for 1920 is indicated by the figures of the exports for the first six months of this year.

At the trials of agricultural tractors held in Linconshire recently by the Royal Agricultural Society of England, it is stated in *The Times* Trade Supplement, October 16, 1920, that two great features of the work of the tractors were the dependability of the leading makes, and their economical use of fuel. On the question of fuel consumption, the fact that tractors can now plough an acre of light land on about 2½ gallons of paraffin in just over an hour, and an acre of stiff clay on about 2¾ or 3 gallons of paraffin in a little longer time, demonstrates their high state of efficiency.

It is asserted in the *Hawaiian Forester and Agriculturist*, September 1920, that anthrax, which became prevalent on certain of the Hawaiian Islands at the time of the entry of the United States into the world war, was undoubtedly introduced there by alien enemies. The aim must have been the destruction of the territory's abundant meat supply, which end might have been attained to a greater degree than occurred, had it not been that the anti-anthrax serum vacine treatment proved so efficacious that the disease was speedily suppressed, with insignificant losses, after the application of the treatment.

In advocating the extension of the area under cotton cultivation in South Africa, a writer in the *Journal of the Department of Agriculture* of the Union of South Africa, October 1920, points out that the demand for the raw material is increasing much faster than the supply. Of the world's population, about 500 million are properly clad 750 million partly dressed, and 250 million practically naked. The population of the world is becoming more civilized, and the first requirement next to food is clothing in some form. The production of other fibres suitable for clothing is so limited that at present the only solution seems to be a very much greater production of cotton.

Compared with the conditions found in some other sugar-growing countries, the sugar plantations in South Africa are remarkably free from such troubles as fungus diseases, borers, mealy-bug, froghopper, etc. Recently, however, some sugar farms in Natal have suffered severe losses from the depredations of rats, which are present in enormous numbers in fields of cane from about ten months old and older. They cause great damage by gnawing through the base of the cane causing it to fall and dry out. The rats causing the trouble appear to be four or five different species of ordinary field rats nearly allied to the common house rat, which they closely resemble in appearance. (The *South African Sugar Journal*, September 1920.)

JAMAICA: ANNUAL REPORT OF THE DEPARTMENT OF AGRICULTURE FOR THE YEAR ENDING MARCH 31, 1920.

This report, which has just been received at the Office of the Imperial Commissioner of Agriculture, contains much interesting matter, and is a record of great progress in agriculture in Jamaica.

The general observations of the Director of Agriculture, Mr. H. H. Cousins, which form the introduction to detailed reports on special matters, give a résumé of the work of the Department, which can hardly be improved on for the purpose of a review. No apology therefore is needed for quoting very freely from this introduction.

With regard to the sisal fibre industry, the report contains so much of general interest and value that a more detailed account will be given of this in another issue of this Journal. It seems evident that the production of this fibre is attaining a position of some importance in Jamaica, which may be developed on lands unsuitable for growing other crops, as well as on better soil.

The period under review has marked the greatest revival in the industrial progress of Jamaica during the past century. This can roughly be shown by the records of the exports for 1919, which show an increase of over 100 per cent. in value over those of the previous year. The producers of Jamaica received nearly £3,000,000 more for their exportable produce than in any recent year, and this prosperity appears to be well maintained with every prospect of a stable market in the future for all the chief products. There is also another side to the matter which gives ground for satisfaction. Jamaica has been compelled by world conditions to produce a great deal that was formerly found to be less trouble, and perhaps cheaper, to import from abroad.

Agriculturally the year was one of low rainfall. Large areas of land suffered from drought in the summer months, and from inadequate autumnal rains. The spring of 1920 has also been one of the driest on record, and in many sections of the island much loss and inconvenience has resulted.

Sugar has made marked progress, with an export of 38,000 tons valued at £1,300,000, while the rum crop raised the total exports of the sugar industry for 1919 to a total of £2,250,000 in value.

The banana industry has made a welcome recovery, and, in the absence of hurricanes, a crop of nearly 10 million bunches of bananas was exported. With the advent of trade competition in the buying of bananas the prices have been raised to a fairer standard, and the growers thereby encouraged to plant and to cultivate their fruit trees. An export of 20,000 boxes of 'evaporated bananas,' valued at £25,000, has been an interesting feature of the year's trade.

The coco-nut crop shows a progressive recovery from the effects of the cyclone of 1917, which did so much damage in the eastern end of the island, by an export of over 24 million nuts, and nearly 700 tons of copra. There was therefore an increased output of about 6 million nuts, as compared with the previous year, while the values show a gain of 100 per cent., or a total of over £300,000 for coco-nuts and copra. Coco-nut diseases have been slight during the year.

Logwood and its extracts have, contrary to expectations, enjoyed a revival of prosperity under post-war conditions, and an improvement of £60,000 over last year's values has been recorded for logwood and its products. At the present moment logwood is selling at high prices, and is in strong demand.

Orange oil has been sold at good prices, and the value of the year's crop is shown to be nearly double that of 1919 for this citrus product. Recently very high prices have been obtained for orange oil, due to a shortage of supply, and many owners of wild orange trees have reaped a welcome harvest.

Cacao has had a good year, with a record of values 90 per cent. greater than in 1919, which was again nearly 25 per cent. in excess of the previous year's record. There has, therefore, been a stimulus to the cacao industry, and a brisk demand has arisen for cacao plants. Unfortunately the year was, on the whole, unfavourable for the establishment of young cacao plants in many sections of the island, and large numbers of the young plants succumbed to drought before they could establish themselves.

Coffee has also shared in the general prosperity, with a gain of about two-thirds in gross value. The price of coffee now justifies the resurrection of this old stable, which was formerly one of the leading products of this island. The Agricultural Instructors play a useful part in encouraging the small growers to greater efforts in the resuscitation of their coffee fields.

Cotton has again received some attention. A small cultivation of Sea Island cotton in Vere resulted in a handsome profit to the grower. 'Cauto' cotton, grown in St. Elizabeth, was also sold for 3*s*. per lb., and a few planters are again experimenting with this staple.

Among minor products the cashew nut may be mentioned. These nuts are highly appreciated in the United States and in England, and, were the supply greater, a useful trade could be developed. Unfortunately the supply is limited, and it does not appear feasible to grow cashews for commercial purposes.

Pimento was in good demand abroad, and the large sum of £184,000 was received for this product. The experiments initiated by the Governor on the commercial possibilities of Pimento leaf oil are now under way.

The exports of hides has been considerable, goat skins alone realizing £44,000. It is believed that when ticks are satisfactorily controlled by compulsory dipping, in accordance with the new legislation which will shortly come into effect, a decided increase in the value of the hides produced in Jamaica will result.

The affect of Imperial Preference on the tobacco industry has been favourable, and Jamaica cigars appear to be gaining an increasing market in various countries; exports to the value of over £100,000 for cigars alone were recorded in 1919. The Jamaica tobacco is essentially a cigar tobacco, but for local consumption a large amount of native tobacco is utilized in cigarettes.

THE IMPROVEMENT IN CROP PRODUCTION IN INDIA.

A paper on the improvement in crop production in India, wnich was read by Mr. Albert Howard, C.I.E., before the Royal Society of Arts, on July 12, 1920, contains much that will be of interest to all who are concerned with agricultural matters.

As is well known, the agricultural conditions of India and its problems are in many respects quite different to those to be found in other parts of the world. The crops are raised by a multitude of small cultivators, conservative, and for the most part unable to command much credit. The average yield per acre has been low, but remarkably constant. The easiest line of advance in improving production, therefore, lies through the plant. The problem was successfully attacked in two directions, by the provision of improved varieties, and by the study of the factors which influence plant growth.

The Indian cultivator rarely pays much attention to the seed he sows. With a few exceptions there is no attempt to keep the different varieties separate, so that mixed crops are the rule. This want of attention to the variety, and the absence of high quality in the final product, correspond closely with the general low standard of agriculture. The work of improving the varieties was started in 1905, and during the last fifteen years a large volume of results has been obtained. New varieties of wheat, which add every year more than £1 per acre to the profits of the cultivators, now cover almost a million acres. The crop, however, to which most attention has been paid is cotton, and in the principal districts in which it is grown, the distribution of new varieties has already affected large areas.

Modern industry demands a uniform product. Not only must each consignment be up to sample, but the product should not change materially from year to year. In this way a reputation is established, and the work of the merchant and of the manufacturer is facilitated. The mixture of varieties, which goes on in the fields of the cultivators, and the want of attention to seed supply, run counter to this demand. It results in a serious loss of uniformity in the produce. The consequence is that Indian produce lacks that uniformity and evenness which modern industries demand. This state of affairs renders it easy to bring about the first stage of improvement in crop production, namely the cultivation of an even product free from admixture. A good example of such an improvement is the distribution of the wheat known as Punjab 11 in the Canal Colonies; this is the predominant constituent of one of the local mixed wheats which used to be very popular among the cultivators round Lyallpur.

The importance of yield in any variety cannot be overestimated. The cultivator is conservative, and is not prone to change either his methods of agriculture, or the local varieties of crop to which he is accustomed. It is difficult to make him take an interest in questions like improved quality, unless an enhanced price can be obtained at once. Every cultivator, however, understands the meaning of a good crop, and of a variety which can be relied on to produce a yield above the average.

Yield is often, however, a pitfall for the plant-breeder in India, where it is always unsafe to disregard the results of exceptional seasons. Many examples could be given where serious mistakes of this nature have been made. Another interesting aspect of yield has arisen in India, where the standard of agriculture, and the general resources of the experiment station are far in advance of those of the people. Varieties sometimes come to the front which prove very disappointing when tried by the cultivators. It therefore follows in India, that the variety possessing the highest potential yielding power is not necessarily the best for introduction to the cultivator. A great deal of judgment is required in selecting the most likely kinds for such a purpose.

Adaptability is essential to the successful variety in India. That is to say, it must do well over a wide range of conditions, and it must also respond successfully to improved cultivation. It is an obvious advantage to all concerned to distribute as few improved kinds as possible, and the number can be materially reduced, if only those possessing great adaptability are finally chosen.

Like many other successful things, the improved variety is a compromise, and does not depend on excellence in a single character. Such things as yielding power and adaptability represent a combination of characters which it is practically impossible to analyse on the score-card principle. No one has yet given a satisfactory quantitative expression to the various units which make up yielding power. A plant-breeder, working on score-card principle, might easily reject a really good variety. Being a compromise, it follows that two much attention must not be paid to single characters. A good example is rust resistance, about which at one time a great deal was heard. The quality of rust resistance has been found to be united with so many weaknesses in other respects, that the efforts to incorporate this quality has resulted in the production of wheats which are little more than curiosities.

The improvement in crop production involves two distinct branches of work. Better varieties are needed, and improvements in the method of growing them have to be devised. In working out improved methods of producing a crop, the physiological aspect is the one which concerns the economic botanist. The chief physiological factors influencing growth are water, dissolved materials in the soil solution, temperature, and air supply. Mr. Howard has omitted to mention light. At the moment in India, crop production is being seriously retarded by factors which interfere with growth over large areas. Already the study of the physiological aspect of crop production has led to important practical results, but much yet remains to be done in this most promising field.

Defective soil aeration is an important factor in many parts of India. In the irrigated tracts this is a constant source of low yields. Cotton in particular seems to be affected; the use of the subsoil water apparently prevents the aeration of the roots for long periods. There can be no doubt that the importance of soil ventilation in agriculture has not always been sufficiently emphasized in the past. While the need of free oxygen in the respiratory processes of the active cells of the roots of plants, and of many of the soil organisms has long been realized, little attention has yet been devoted to it in agricultural research.

A little consideration will show how this has arisen. Till recent years the Agricultural Experiment Stations of the Empire have been situated in humid regions, where the rainfall is well distributed. Rain is practically a saturated solution of oxygen, and is very effective in supplying this gas to the soil whenever percolation is possible. Hence, in such regions crops are not likely to suffer from poor soil aeration to anything like the same extent as those grown in the arid regions of the world.

Flood irrigation, by producing a more or less impermeable surface crust, and by reducing the volume of the pore space of the soil, seriously interferes with aeration. Irrigation supplies the water, but it tends to deprive the soil of air; it is conceivable that the torrential rains may have the same effect in the West Indies, and that much of the trouble experienced from the shedding of the buds and bolls of the cotton plant might be alleviated, if the formation of an impermeable surface crust could be prevented.

DOWN THE ISLANDS.

ITEMS OF LOCAL INTEREST.

ST. LUCIA. During the month of November the following plants were distributed from Réunion Experiment Station: lime plants 700, Casuarina 225, rose plants 12. From the Botanic Gardens, Castries, the distribution was as follows: cacao 249, *Coffea robusta* 170, mango 'Julie' 2, ornamental plants 32, and 12 packets seeds of economic plants. Regarding staple crops, Mr. E. A. Buckmire, Acting Agricultural Superintendent, states that frequent heavy showers throughout the month adversely affected the canefields in the wet districts. Rivers overflowed their banks and washed through adjoining fields, uprooting a great number of stools, while the debris in the rush of the flood laid low acres of canes. Clearing the rubbish, replanting, and clearing out drains had to be given regular attention. In the drier districts the rains were very beneficial, and the outlook is satisfactory. The lime crop is again in full swing, and the Government Lime Juice Factory was kept busy throughout the month. Lime products bought at the factory, were as follows: 952⅓ barrels of fruit, 2,786 gallons of lime juice. The quantity of juice handled during the month was 7,860 gallons. The local market for cacao is very low, consequently very little attention is given to reaping this crop. There was much activity amongst the peasantry, particularly in the drier districts where large patches were planted with sweet potatoes and cassava. In the wet mountainous districts, land slips were numerous, on most of which provision gardens had been established. Whole gardens have been washed away by rushing water. Many animals, particularly cattle and pigs, were carried away by overflowing rivers and ravines. The rainfall recorded at the Botanic Gardens, Castries, for the month was 12·26 inches; at the Agricultural and Botanic Station, Choiseul, 7·05 inches.

DOMINICA. During the month of November 15,000 lime seedlings were transplanted in the nurseries at the Experiment Station. Plant distribution comprised 5,525 lime plants, 100 cacao, 43 budded citrus, 1 grafted mango, 7,050 sugar-cane cuttings, 50 shade tree cuttings, 80lb onion seed, 38lb horse beans; and in addition, 202 packets vegetable seeds were sold. The local price for ripe lines, Mr. Jones says, fell from 4*s*. 6*d*. to 4*s*. 4*d*. per barrel. The market for concentrated lime juice continues in a depressed condition. The second crop of limes is reported to be a good one. The cacao crop is late. A visit on November 25, of Sir Francis Watts, K.C.M.G., Imperial Commissioner of Agriculture, is noted; also visits by Miss E. M. Wakefield, Acting Mycologist, Imperial Department, for the purpose of studying plant diseases; and by Mr. H. A. Ballou, Entomologist of the Staff of the Department, on his way to the Northern Islands on duties connected with his office. Heavy squalls were experienced on the morning of November 1. The rainfall for the month was 4 62 inches.

MONTSERRAT. Plant distribution for the month of November included 250 bay plants, 60 lime plants, and 21 packets of various beans. Mr. W. Robson, the Curator, mentions the discovery, on November 5, of the pink bollworm of cotton in Montserrat Consequent on this discovery Mr. H. A. Ballou, Entomologist on the Staff of the Imperial Department of Agriculture, visited Montserrat from November 22 to 26, for the purpose of advising the adoption of measures for combating the pest. In view of the prevalence of pink bollworm it has been decided to enforce the destruction of old cotton plants at December 31. In connexion with the foregoing, a meeting of planters was held, at which the presence of the pink bollworm was discussed, and Mr. Ballou made recommendations for its control. The rainfall recorded at Grove Station during the month was 7·29 inches. The total rainfall for the year to date is 47·55 inches.

ANTIGUA. Plant distribution during November included 13 decorative plants, 3 Tacsonia, 22 papaw, 9 *Melocactus communis*, 1 packet Indian corn seed, 1 packet Whitewood seed, 1 packet Sudan grass seed, and 443¼lb onion seed. Mr. Harcourt states in reference to staple crops, that the sugar-cane crop now shows a decided improvement, due to the influence of continued showers of rain. The cotton crop still continues to improve. Cotton stainers are appearing in some districts, but the attacks at present are only slight. Leaf-blister mite is prevalent in one district. Visits by Miss E. M. Wakefield, Acting Mycologist, and Mr. H. A. Ballou, Entomologist, of the Imperial Department of Agriculture, during the month are noted. The rainfall recorded during the month at the Botanic Station was 4·07 inches; for the year to date, 28·24 inches.

ST. KITTS. Mr. Shepherd writes to say that the good showers during the month of November have much improved the condition of the cane crop, especially in the northern district. The canes are healthy and under vigorous growth Preparation for planting the young cane crop is proceeding, and on some estates planting has begun. The reaping of the cotton crop in the northern district is practically complete; in other districts picking is progressing rapidly, and the returns are fair. The cotton worm has given much trouble Pink bollworm was discovered at La Guérite on November 15, and has since been located all along the south-western side of the island. The damage done, so far, has been slight, showing that the original infestation must have been of recent date. Visits by the Imperial Commissioner of Agriculture, and Mr. H. A. Ballou, Entomologist, in connexion with the pink bollworm, are noted. Leaf-blister mite is said to be attacking cotton in the other districts. At meetings of the Agricultural Society held during the month, resolutions were passed in favour of limiting the duration of the close season for cotton to one month, and prohibiting the importation of canes or cane cuttings from any country. The rainfall for the month was 4·36 inches for the year to date, 34·65 inches.

MARKET REPORTS.

London.—THE WEST INDIA COMMITTEE CIRCULAR, October 28.

BALATA—Venezuelan Block, no quotations; West Indian Sheet, 4*s.* 2*d.* to. 4*s.* 3*d.* c.i.f., spot 4*s.* 7*d.*
BEESWAX—No quotations.
CACAO—Trinidad, 78*s.* to 80*s.* Grenada, St. Lucia, and Jamaica, 72*s.* Dominica, no quotations.
COPRA—£57. London, and £58 10*s.* c.i.f. Holland.
HONEY—62*s.* 6*d* to 90*s.*
LIME JUICE—Raw, no quotatons. Concentrated, no quotations.
PIMENTO—4*d.*
RUBBER—Para, fine hard, no quotations; fine soft, no quotations; Castilloa, no quotations.

Barbados—Messrs. T. S. GARRAWAY & Co., December 7.

ARROWROOT—$8·00 per 100 lb. duty paid.
CACAO—Lottings at $16·00
COCO-NUTS—$50·00 for large, $36·00 for small husked nuts.
HAY—Sales at $6·00.
ONIONS—Lottings at $7·50.
PEAS, SPLIT—No quotations; Canada, $12·00 small.
POTATOES—New crop, sales at $7·75 per 160 lb.
SUGAR—$10·00 per 100 lb.

London.—THE PERFUMERY AND ESSENTIAL OIL RECORD October 22.

BAY OIL—26*s.* per lb. spot.
LIME OIL—5*s.* for West Indian distilled, and for hand-pressed 23*s.* per lb.
ORANGE OIL—West Indian, no quotations.

Trinidad.—Messrs. GORDON, GRANT & Co., October 6.

CACAO—Venezuelan, $18·50.
Trinidad, $17·25 to $17·75.
COCO-NUT OIL—$1·95 per gallon.
COFFEE—Venezuelan, 16c. to 17c. per lb.
COPRA—9c. per lb.
DHAL—No quotations.
ONIONS—$8·75c. per 100 lb.
PEAS, SPLIT—$8·75 per 100 lb.
POTATOES—English, 8 to 10c. per lb.
RICE—Yellow, $14·50. White, no quotations.
SUGAR—No quotations.

New York.—Messrs. HUTH, GILLESPIE & Co., Inc. November 18.

CACAO—Caracas, 12½c. to 13c.; Grenada, 11c. to 11½c; Trinidad, 11½c. to 12c.; Jamaica, 8c. to 9c.
COCO-NUTS—Jamaica selects, $48·00 per M; Trinidad $32·00 per M; Jamaica, $45·00; Trinidad $40·00 per M. culls.
COPRA—7c.
COFFEE—Jamaica, 9½c. to 12c. per lb.
GINGER—24c. to 27c. per lb.
GOAT SKINS—Jamaica 60c; Antigua, Barbados, St. Thomas and St. Kitts 50c.
GRAPE FRUIT—Jamaica, $3·00 to $5·00 per box.
LIMES—$6·00 to $8·00.
MACE—28c.
NUTMEGS—15c.
ORANGES—$3·00 to $3·50 per box.
PIMENTO—5¾c.
SUGAR—Centrifugals, 96°, 6½c.; Muscovados, 89°, 5½c. c. & f., Molasses, 89°, 5½c.

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